Railway Mechanical Engineer

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Contents

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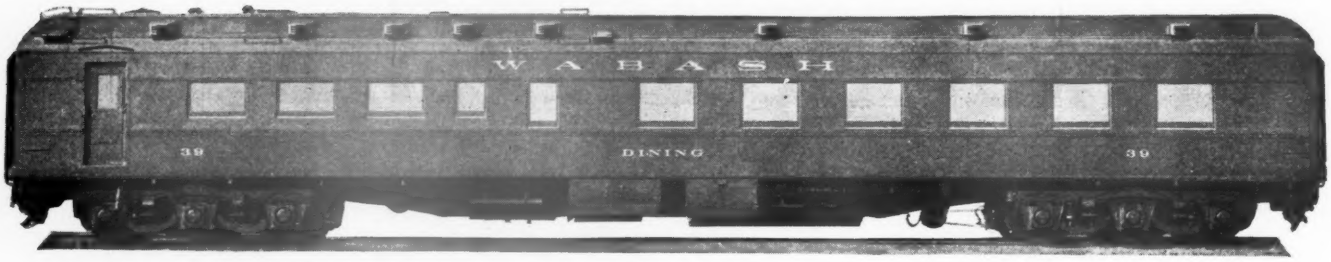
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Persistence in safety work

The value of an organized campaign and persistent effort in increasing the safety of mechanical department operation has again been demonstrated in no uncertain way on the Kansas City Southern. According to the interesting Mechanical Department Bulletin, published monthly by this road, 1927 was a banner year from the point of view of safety. While the track department won the safety banner with a record of 608,997 man-hours per reportable injury, the mechanical department as a whole made a highly creditable performance with an increase over 1926 of 25 per cent in man-hours per injury and a corresponding reduction in the number of injuries. Of eight system mechanical department units, four made more than 100,000 man-hours per reportable injury (the goal set for 1927) and all made more than 80,000 man-hours per injury. One of the eight established a record of 234,360 man-hours of work without a single reportable injury and, had this unit worked a larger force in 1927, it might have won the system banner. Unquestionably, safety work pays big dividends to both railroad and employee. The price is eternal vigilance on the part of shop and enginehouse forces, stimulated by an intelligent campaign of education and inspiration, such as the Kansas City Southern is carrying on. With the establishment of definite goals slightly higher each year, desirable results are bound to be secured.

Unusual application of university extension

Industrial and railroad representatives from many countries have visited the United States in recent years to study our methods and practices. Industrial students from this country have gone abroad to make similar studies to a much lesser degree, and this is particularly true of railroad officers and especially of those associated with the mechanical department. For this reason the engineering tour to Europe, which is scheduled for the coming summer, under the auspices of the University Extension Division of Rutgers University, a similar department of Pennsylvania State College and of the Massachusetts State Department of Education, is of more than ordinary interest. The party will be under the immediate direction of Prof. N. C. Miller of Rutgers, who has made such favorable contacts during the past two years in dealing with the railroad groups in the mechanical departments of railroads in New Jersey. The study of industrial organization and management will be under the direction of Prof. J. O. Keller, professor of industrial engineering at Pennsylvania State College. Prof. J. A. Moyer, director of university extension of the Massachusetts State Department of Education, will supervise the course on power plant economics.

The party will sail about the middle of July and will return toward the end of August. A large part of the time which will be spent in England and on the Continent will be given over to excursions to various types of industrial establishments, the first of these being a visit to the Great Western Railway of England's locomotive works at Swindon, and the last one being an inspection of the power plant and rapid transit system in Paris. There should, of course, be great possibilities in a study of this kind, particularly when led under the direction of men who have given so much time and effort to university extension work in the industries.

Air brake development

A tribute was paid to railroad air brake maintenance forces at the January meeting of the Western Railway Club, when representatives of the Westinghouse and New York Air Brake Companies testified that the present general standards of maintenance of the pneumatic parts of the equipment are largely satisfactory. A number of roads handling heavy passenger traffic or freight trains on severe grades have for years been compelled to maintain high standards, but, within the past five years, the general appreciation of the necessity for and advantages of these high standards of maintenance has gradually led to their general adoption.

While general railroad practices in the repair and testing of air brake valves seem to be satisfactory, there is room for improvement in the care given to these valves between the time they leave the test rack and their application in service. The evidence seems to indicate that in far too many cases valves are handled carelessly in shipment to or from the store room and damaged in spite of having the ports carefully blanked, requiring subsequent tests before being sure that they are fitted for application. More effort to educate all employees handling air brake valves to a full understanding of the important work the valves perform and the serious effects which may follow their rough handling would, no doubt, prove profitable.

Another point raised at the meeting mentioned was the condition of foundation brake rigging which was said to be far less satisfactory than that of the pneumatic parts of the brake equipment. In fact, non-standard and defective parts of the foundation gear are said to be responsible for many irregularities in brake action now unjustly charged to the pneumatic equipment. It appears that sufficient rules are already in effect regarding the

foundation brake rigging but a campaign for the better observance of these rules is urgently needed.

Another point brought out in a striking manner is that, while 1928 is the sixtieth anniversary of the first practical application of air brakes and most of the major developments have already apparently taken place, air brake growth and improvement are by no means dead. The representatives of the air brake companies referred to illustrated and described a surprising number of improvements now in process of development. These include refinements in the design of air compressors, air cleaners, brake valve assembly pedestals, oil cups, piston packing rings, governors, feed valves, reservoirs, retaining valves, angle cocks, brake cylinders, packing rings, cylinder dirt excluders, etc. Unquestionably the air brake manufacturers are looking ahead with a view to meeting fully modern operating requirements, effecting improvements with a minimum interference with existing standards and providing air brake equipment which will last longer and therefore cost less to maintain.

The railroads should meet this challenge of the brake companies by tightening up on air brake maintenance standards with particular attention to the foundation brake rigging, providing for the more careful handling of valves and in some cases a more intelligent use of the valuable soap suds test for leakage, the results of which are now sometimes misinterpreted.

Two ideas on the hot box problem

Success in keeping the number of hot boxes down to a minimum means a continual "punching up" of those who do the actual work. This statement briefly describes the policy adopted several years ago by one road, which has achieved a remarkable low record for the number of hot boxes occuring on its lines. In 1926 it was found that some of the ca. repair and interchange points were neglecting to repack boxes that should have been repacked. From a study of the records of the number of journal boxes repacked per year in relation to the total number of cars handled and the total number of hot boxes, an estimate was made of the number of boxes which should be repacked on the entire system in order to reduce the number of hot boxes to the lowest practicable minimum. This estimate was arrived at after the data had been discussed at several staff meetings.

The total was apportioned among the various car repair and interchange points according to the number of cars handled at each point. Monthly reports received from each repair point as to the number of journal boxes repacked are consolidated in the office of the head of the car department. This consolidated report shows the number of boxes repacked at each point compared with its monthly quota. This report is presented and discussed at the monthly staff meeting of the car department foremen.

Of course, this system has increased the total number of repacked journal boxes, the figure for 1927 being over 50 per cent greater than that for 1926. On the other hand, the number of freight car-miles per hot box was increased by 8,000 in 1927 as compared to 1926 and the passenger car-miles per hot box by nearly 800,000.

An increase in the number of hot boxes is cause for investigation by all car department officers concerned. Recently an increase was reported in the number of hot boxes on passenger equipment. Investigation showed that this was due to the high viscosity of the oil on some new passenger cars, which caused the packing to adhere to the journal. Some car journal boxes were found with the packing lifted entirely from the bottom of the box. Conditions were improved at once by using an oil of lower viscosity and a good quality of reclaiming packing.

These two illustrations show what can be done toward inducing men who work a large part of their time without close supervision, to do their work right; and also what can be accomplished by prompt investigation and application of suitable remedial measures. Continual agitation and close attention to what appear to be items of little importance when considered separately, seems to be the only way to cope successfully with the hot box problem.

Do you know your machines?

A superintendent of motive power on making an inspection trip through one of the secondary shops on his road, noticed an idle machine which, though comparatively new, bore evidence of not having been used for some time. The machine shop foreman, when questioned as to the reason for the idleness of the machine which in this case represented an eight-thousand-dollar investment, ventured the reply that he had never found very may jobs that could be handled on the machine. The superintendent of motive power ordered the foreman immediately to make trips to two or three nearby shops on other roads where similar machines were in operation and report back as to just what extent the machine in question was adapted to the work.

The result of the investigation was that the foreman discovered there were not only over 50 different jobs which the machine could economically handle but that in many cases the machine could cut the production time on certain jobs as much as 75 per cent. Further investigation disclosed the fact that, properly tooled, this machine could handle as much work as two other machines. The net result of the entire investigation was a saving of several thousand dollars in the course of a year.

The object lesson in such an incident is not so much the possibility of a greater utilization of machine tool capacity as the impression it leaves on the value of making thorough investigations into the potential productive capacity of individual machines, particularly in relation to modern types. It has been said that over 50 per cent of the machine tools in railroad shops are over 12 years old. A few serious diagnoses of machine tool conditions in most shops might show where one modern machine could replace two or three of these older machines and with a single operator still cut the output time on certain jobs in half.

How much does it cost?

The question may be asked, "What does it cost the railroads each year to operate freight cars with deficient draft gears?" but there can be no answer because nobody knows the amount of damage either to lading or to car structures chargeable to this cause. A correspondent of the *Railway Mechanical Engineer* recently expressed the matter in the following way which seems worth repeating here: "Railroads generally have no facilities for determining the cost of repairs, due to inefficient or defective draft gears. This item of expense is generally lumped under the head of freight car repairs and is not segregated where it can be brought to the attention of the proper authorities. In

a few instances, railroads have attempted to sub-divide their freight car repairs under a few principal items such as roofs, doors, ends, trucks, etc., but rarely if ever has there been an effort to charge all of the freight car repairs that may be attributable to draft gear failures." While a definite knowledge of the percentage of car maintenance cost due to ineffective draft gears is not available, many estimates, some as high as 75 per cent, have been made by experienced car men. On one basis of figuring, the present average cost of labor and material for repairs to car wheels, axles, journals, air brakes and other items unaffected by draft gear condition, amounts to $48 per car per year. An American Railway Association circular shows the present (1925) total cost of repairs as being $152 per car per year. This leaves $104 or about 68 per cent due to inadequate draft gear protection accentuated by unnecessary rough handling. Irrespective of whether this ratio is 75 per cent, 68 per cent or only 50 per cent, the amount of money involved represents a big margin over the cost of replacing older inadequate draft gears and maintaining those which can be rehabilitated to meet modern operating requirements.

More rigid inspection of power needed

The sixteenth annual report of the chief inspector of the Bureau of Locomotive Inspection made to the Interstate Commerce Commission shows that during the last fiscal year ended June 30, 1927, a total of 97,222 locomotives were inspected of which 29,995 or 31 per cent were found defective. For the same period a total of 2,539 locomotives were ordered out of service. For the fiscal year ended June 30, 1923, a total of 63,657 locomotives were inspected of which 41,150 or 68 per cent were found defective and 7,075 were ordered out of service. These two sets of figures show that since 1923, a decided improvement has been made in enforcing more rigid inspection and the repairing of defects as reported by both the terminal inspectors and the enginemen. The fact that a total of 29,995 locomotives were reported defective seems to indicate that there is much room for improvement. The ideal aimed at by all roads is to maintain its power in perfect condition at all times. In order to attain this ideal, it is necessary to establish an airtight system of inspection and of maintenance. If the inspectors do not report the defects as they exist, how can the maintenance department make adequate repairs? On the other hand, if the defects are religiously reported by the inspectors, but not repaired as reported, how can the roads expect to operate locomotives without defects? Perhaps many mechanical department officers feel that it is an almost hopeless task to approach the ideal condition. Those who entertain such a feeling can gain much comfort and encouragement from the excellent showing made by two relatively large systems, one located in the middle west and one in the east. The first mentioned road during 1923, had a total of 643 locomotives inspected of which 82 per cent were found defective and 89 ordered out of service. This same road for 1927, had a total of 1,075 locomotives inspected of which six per cent were found defective and only two were ordered out of service. The reason for this remarkable improvement is that a concentrated drive has been made to improve the standards of inspection and to require that the defects reported by the inspectors be repaired. Deferred maintenance is not tolerated on this road.

The eastern road has done equally as well in eliminating defective locomotives. During 1923, a total of 1,055 locomotives were inspected of which 73 per cent were found defective and 131 ordered out of service. This road, during 1927, had a total of 1,181 locomotives inspected of which 23 per cent were found defective and only five ordered out of service. The same rigid inspection and maintenance requirements have been set up by this road. These two roads are rapidly approaching the ideal condition. Other roads can more closely approach this much desired ideal condition of power by further tightening up on inspection and maintenance. High standards, once attained, are less difficult to maintain than the low standards which constantly risk the disruption of the service by engine failures and power detentions enforced by the federal inspectors.

New Books

AN INTRODUCTION TO THE METALLURGY OF IRON AND STEEL. *By H. M. Boylston, B. S., A. M., Met. E., Professor of Metallurgy, Case School of Applied Science.* 571 *pages, illustrated..* 6 *in. by* 9 *in. Price* $5. *Published by John Wiley & Sons, New York.*

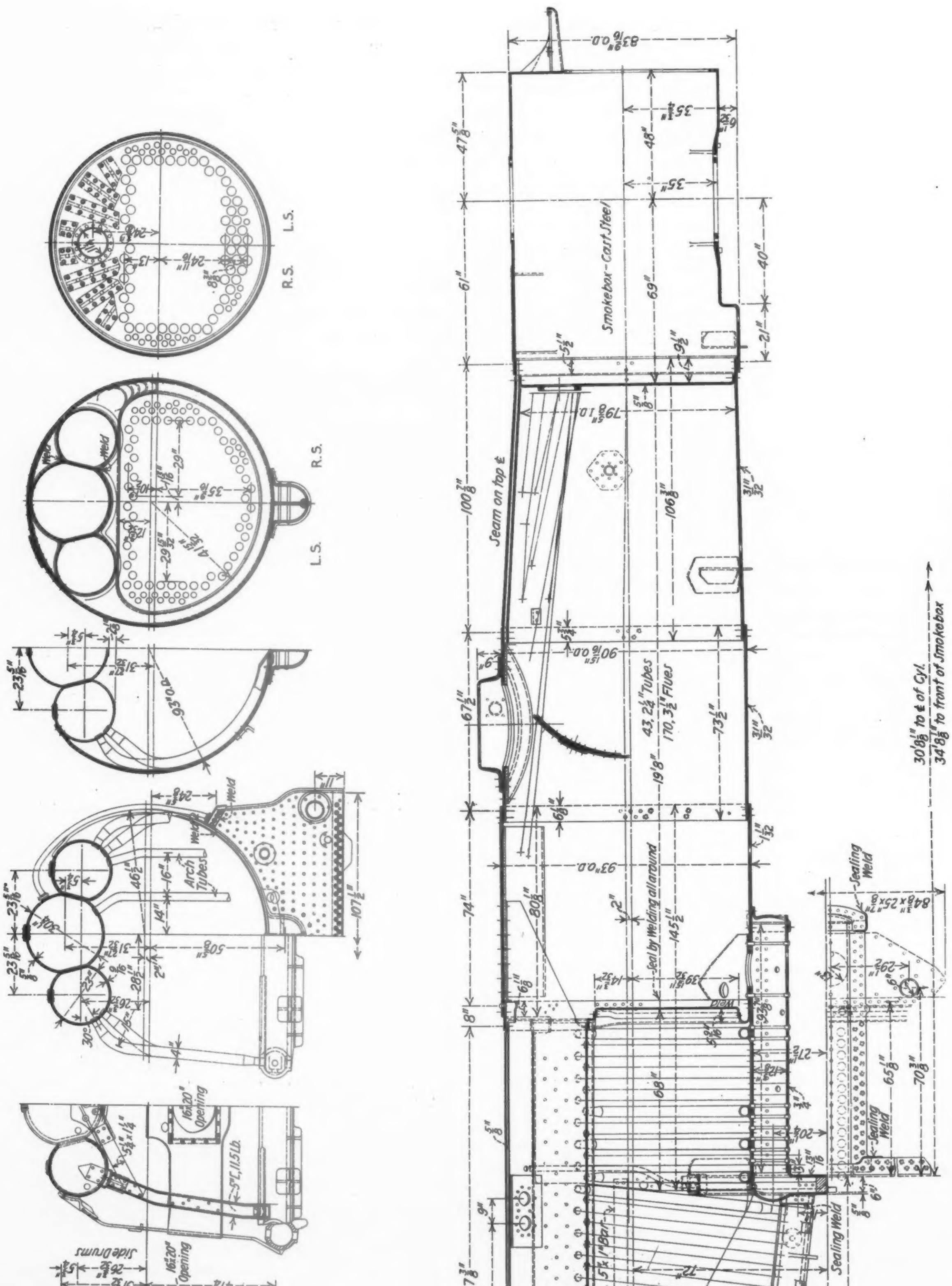
This book is a substantial introduction to a very broad and highly technical profession and the author has utilized many sources of information in compiling his material. He has endeavored to tell of the fundamentals of iron and steel making in as simple a manner as possible and at the same time not to restrict the text to words of one syllable.

The book contains 25 chapters and an appendix. Some of the subjects discussed in entire chapters, such as the chemical and physical principles of iron and steel; the mechanical treatment of steel; the composition, structure and physical properties of iron and steel; and the heat treatment of steel, should be of special value to the railroad master blacksmith. The remaining chapters are devoted to discussions of the various processes and methods for making pig iron, wrought iron, steel, etc. The appendix contains the American Society for Testing Materials' tentative definitions of terms relating to heat treatment operations.

PROCEEDINGS OF THE INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION. 259 *pages, illustrated,* 6 *in. by* 9 *in., paper bound. Published by the Association, William Hall, secretary-treasurer,* 1061 *West Wabasha street, Winona, Minn.*

This is the report of the twenty-second annual convention of the International Railway General Foremen's Association which was held at the Hotel Sherman, Chicago, September 6 to 9, 1927, inclusive. The papers and subjects discussed include supervisory officers and railway efficiency, engine handling at terminals, Terminal delays to cars—what can be done by the mechanical department to reduce them?, Co-operation by general foremen with the purchases and stores department, Relation of reclamation to stock reduction, Passenger car shop organization, How to obtain a higher standard of equipment maintenance, and Determining the fitness of employees for promotion.

The Proceedings of the International Railway General Foremen's Association contains much information that is of value. The indexing however, makes it difficult to locate any subject readily. The table of contents gives only the names of the authors and not the subjects of the papers and reports.



Elevation and cross section drawings of the boiler of the New Haven three-cylinder 4-8-2 type locomotives

Three-cylinder locomotives for the New Haven

Ten 4-8-2 type equipped with McClellon fireboxes and Bean smokeboxes—Tractive force, 71,000 lb.

TEN three-cylinder, 4-8-2 type locomotives were recently received from the American Locomotive Company by the New York, New Haven & Hartford which were expressly designed for hauling heavy trains at high speeds. These locomotives are unusual in that they are equipped with the McClellon water tube firebox, the Bean one-piece smokebox and cast steel cylinders.

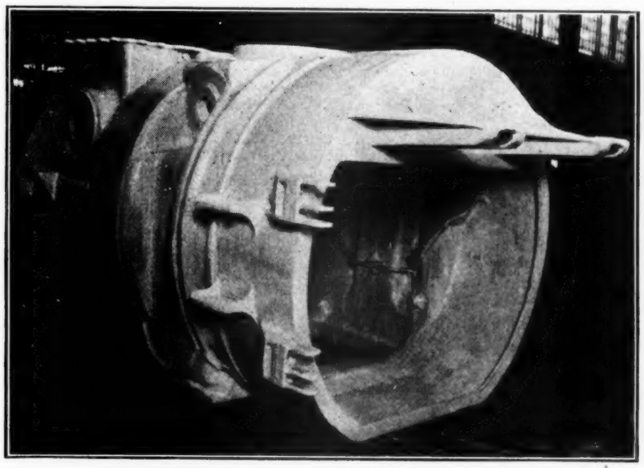
The diameter and stroke of the cylinders is 22 in. by 30 in. with a boiler pressure of 265 lb., a driving wheel diameter of 69 in. and a weight on the drivers of 260,000 lb., these locomotives will develop a tractive force at 85 per cent cut-off, of 71,000 lb. They carry the highest boiler pressure and develop the greatest tractive force of any locomotive on the New Haven.

Increasing demand for expeditious handling of traffic on the New Haven has made greater speed in the movement of its freight essential. The new locomotives were designed to meet these conditions. They will pull, at passenger train speed, 100 loaded cars weighing 5,000 tons. It is planned to use this power in fast freight service between Maybrook, N. Y.—the New Haven's western gateway—and Boston, Mass., the longest freight train run in New England, a distance of 275 miles. The new power will replace the locomotives which have handled these runs for several years.

Changes made in the McClellon boiler

The locomotives are equipped with McClellon boilers, a general description of which was published on page 143, in the March, 1926, issue of the *Railway Mechanical Engineer*. Modifications have, however since been made in the work. The back tube sheet is made in two sections. The outer section consists of a ring flanged into the water side connecting to the third shell course, with an opening at the top flanged toward the fire side to receive the firebox drums. This construction is the same as on the previous engines of this type. However, instead of the tube section being integral as on the previous locomotives it is made in a separate piece, and joined to the outer ring by a riveted joint, its flange being turned toward the fire side. No braces are used in the back tube sheet. This form of construction will, it is believed, provide for the necessary flexibility between the tube section and the barrel of the boiler, and also greatly facilitate the renewal of the back tube sheet.

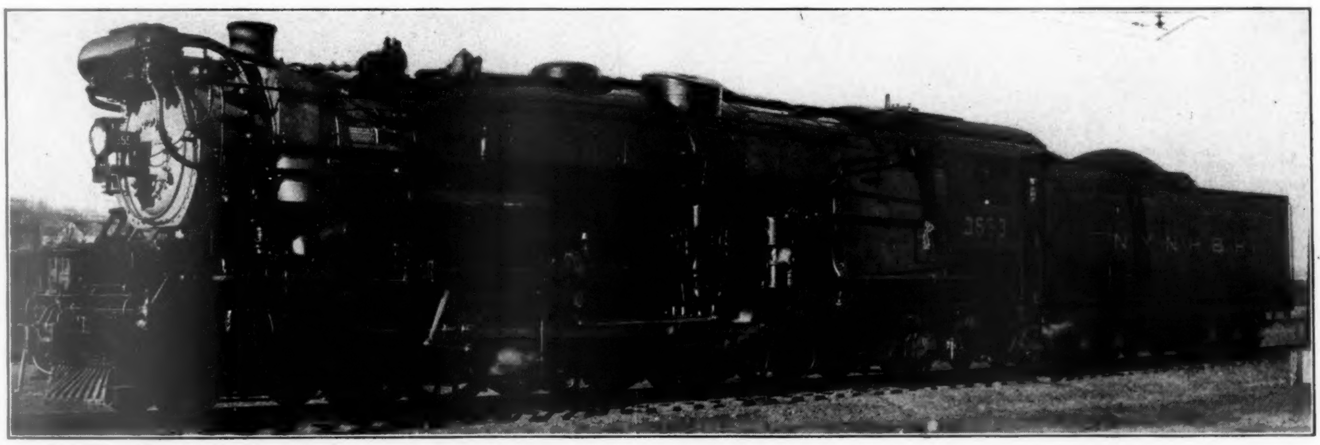
Additional circulation has been provided for between the hollow mud ring and the barrel, through two



The Bean smokebox, a one piece casting, is designed to eliminate air leaks

circulating pipes extending from each front end of the mud ring, and connecting to the barrel just ahead of the back tube sheet. These additional circulating pipes are to improve the circulation.

A change has been made in the method of lagging the firebox. Ascoloy steel sheets are applied next to the tubes from the drums to the mud ring, completely sealing the firebox. The lagging is applied outside of



One of the New Haven 4-8-2, three-cylinder locomotives which develop a tractive force of 71,000 lb.

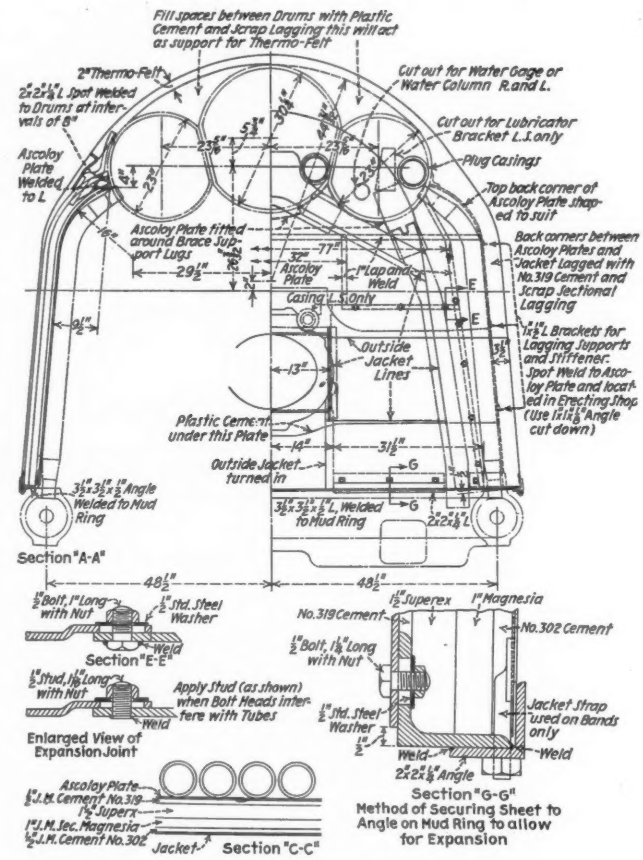
the Ascoloy sheets and a jacket outside of the lagging.

Other changes in the locomotives

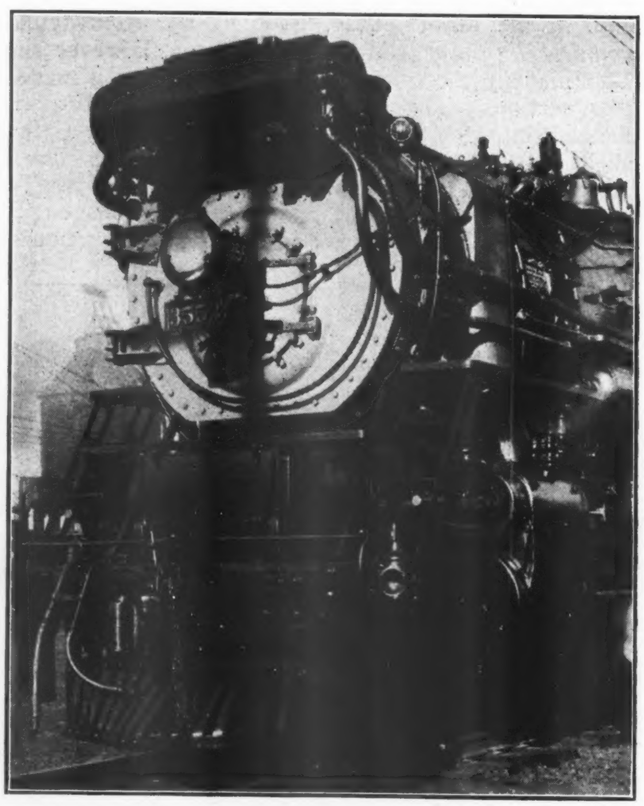
Outside of the boiler the principal modifications over the previous engines are in the use of cast steel cylinders and the Bean cast steel smokebox. The steel cylinders have effected a saving in weight of approximately 6,000 lb. The Bean smokebox, which was described on page 533 in the August, 1927, issue of the *Railway Mechanical Engineer,* is designed to eliminate air leaks and to facilitate the application and removal of front end netting and deflector plates. Instead of being made of rolled steel plates, shapes, etc., it is cast in one piece, thereby giving simplicity and strength, also absence of air leaks so detrimental to fuel economy. The smokebox also includes lugs at the front and back which are tightly fitted to flanges on the cylinder which is, in turn, further locked to the smokebox by similar flanges and keys welded in place. This

Table of dimensions, weights and proportions of the New Haven 4-8-2 type locomotives

Railroad	New York, New Haven & Hartford
Type of locomotive	4-8-2
Service	Fast freight
Cylinders, diameter and stroke	3 cyl., 22 in. by 30 in.
Valve gear, type	Walschaert
Valves, piston type, size	11 in.
Maximum travel	6 in.
Outside lap	1 1/16 in.
Exhaust clearance	3/16 in.
Lead in full gear	¼ in.
Cut-off in full gear, per cent	85
Weights in working order:	
On drivers	260,000 lb.
On front truck	58,500 lb.
On trailing truck	60,500 lb.
Total engine	379,000 lb.
Tender	288,500 lb.
Wheel bases:	
Driving	19 ft. 9 in.
Rigid	12 ft. 2 in.
Total engine	42 ft. 3 in.
Total engine and tender	85 ft. 4 in.
Wheels, diameter outside tires:	
Driving	69 in.
Front truck	33 in.
Trailing truck	44 in.
Journals, diameter and length:	
Driving, main	11½ in. by 14 in.
Driving, others	10½ in. by 14 in.
Front truck	6½ in. by 12 in.
Trailing truck	9 in. by 14 in.
Boiler:	
Type	McClellon
Steam pressure	265 lb.
Fuel, kind	Bituminous
Diameter, first ring, inside	79⅝ in.
Firebox, length and width	120 in. by 85 in.
Arch tubes, number and diameter	4—3 in.
Combustion chamber length	68 in.
Tubes, number and diameter	29—2¼", 14—3½"
Flues, number and diameter	170—3½ in.
Length over tube sheets	19 ft. 8 in.
Grate area	70.8 sq. ft.
Heating surfaces:	
Drums	96 sq. ft.
Combustion chamber tubes	95 sq. ft.
Firebox side tubes	145 sq. ft.
Firebox back tubes	35 sq. ft.
Firebox back section	2 sq. ft.
Arch tubes	27 sq. ft.
Firebox tube sheet and throat	51 sq. ft.
Total firebox	451 sq. ft.
Boiler tubes and flues	3,634 sq. ft.
Total evaporative	4,085 sq. ft.
Superheating	1,756 sq. ft.
Combined evaporative and superheating	5,841 sq. ft.
Tender:	
Style	Water bottom
Water capacity	16,000 gals.
Fuel capacity	18 tons
General data estimated:	
Rated tractive force, 85 per cent	71,000 lb.
Weight proportions:	
Weight on drivers ÷ total weight engine, per cent	68.5
Weight on drivers ÷ tractive force	3.65
Total weight engine ÷ comb. heat. surface	64.9
Boiler proportions:	
Tractive force ÷ comb. heat. surface	12.1
Tractive force × dia. drivers ÷ comb. heat. surface	841
Firebox heat. surface ÷ grate area	6.37
Firebox heat. surface, per cent of evap. heat. surface	11.2
Superheat. surface, per cent of evap. heat. surface	42.9



A cross-section of the firebox and some of the details showing how the lagging is applied



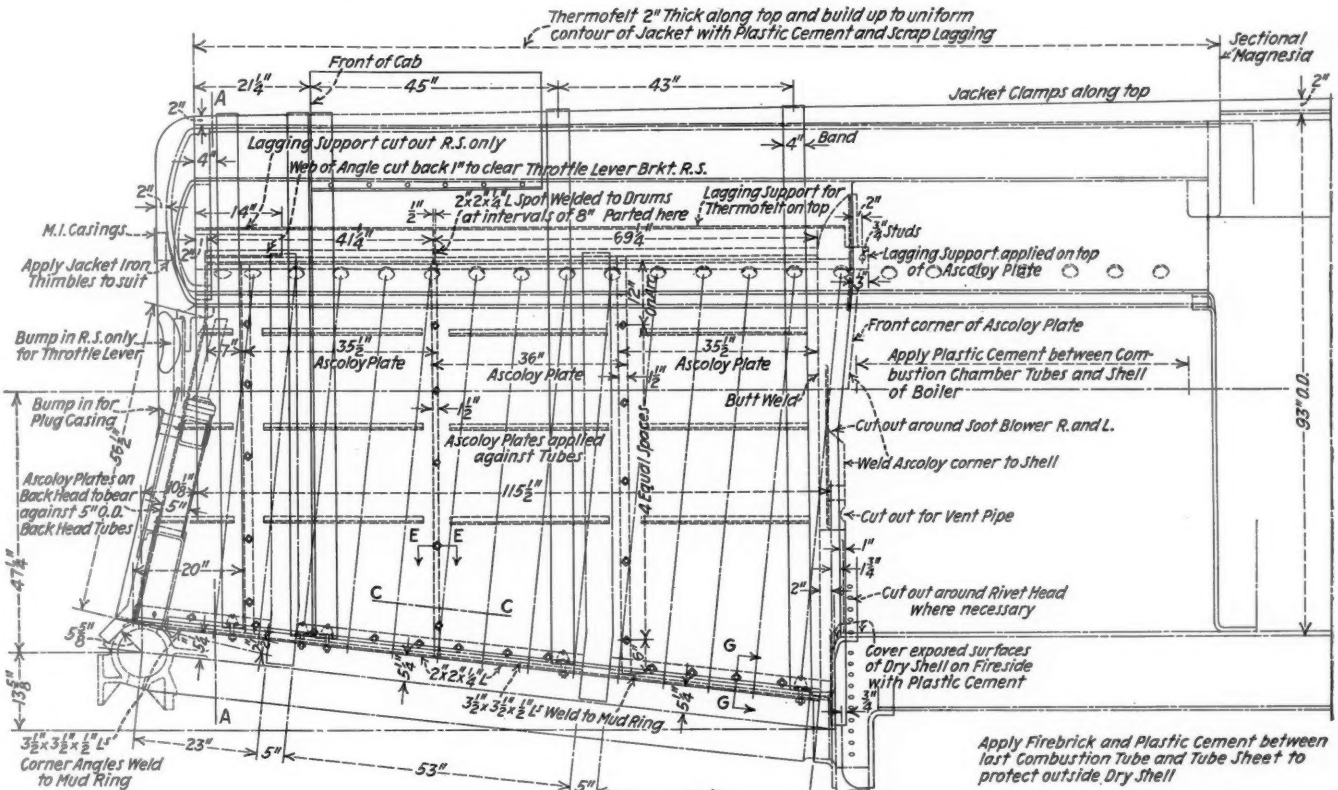
The front end with its various brackets is cast in one piece

scheme insures positive and constant alinement of the frames and the maintenance of the correct position of wheels, axles, boxes, guides, valve motion, etc., thus tending to reduce maintenance costs.

Instead of the usual angles that are bolted to the inside of the smokebox, with the bolt holes causing air leaks, the small integral lips will receive the interlocking front end arrangement, which can be applied and removed in about one-third of the time needed for the removal of the older arrangement.

The running gear follows the previous locomotives of this type, the New Haven's standard being used wherever possible. The Commonwealth engine truck is used, the engine truck boxes being provided with the removal type of hub liner. The front drivers are provided with lateral motion boxes. The outside main rods connect the No. 4 and the inside main rod to the No. 3 wheels. The main rods have solid front end bushings and floating back end bushings. The side rods have floating bushings in the middle connection in accordance with the New Haven's standard. All pin connections in the spring rigging and brake rigging are fitted with case hardened bushings. The Commonwealth delta type trailing trucks are used, with floating hub liners at the trailer wheels.

Care has been taken with the piping and back head arrangement to secure a pleasing appearance. All the piping possible, including sand traps and piping has been placed under the jacket. Where piping could not be placed under the jacket, care has been taken to run the piping along horizontal and vertical lines as far as possible. All steam pipes and valves, as far as possible, have been kept outside the cab under a turret housing over the top of the boiler in front of the cab. The steam valves in the turret are operated by extension handles which pass back through the cab where they are arranged in a neat line across the top of the firebox on a control board with each handle clearly labeled. With the exception of the air and back pressure gages, all of the gages are mounted in a straight line arrangement on an instrument board.



By using Ascoloy plates and four layers of lagging and cement, the firebox is completely sealed

Among the special equipment included on these engines are feedwater heaters, automatic train control, force feed lubricators, air operated whistles, automatic bell stops, soot blowers, stokers and multiple throttles.

A folding door in the side of the tank provides access to the engine compartment for inspection and repairs.

The tenders are of the rectangular type, having a capacity of 18 tons of coal and 16,000 gallons of water. They are carried on Commonwealth six-wheel trucks, fitted with the clasp brakes.

* * * *

Interior of Machinery Hall at the Leipzig Trade Fair—This fair is held annually and is international in scope

the Ascoloy sheets and a jacket outside of the lagging.

Other changes in the locomotives

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Wheel bases:	
Driving	19 ft. 9 in.
Rigid	12 ft. 2 in.
Total engine	42 ft. 3 in.
Total engine and tender	85 ft. 4 in.
Wheels, diameter outside tires:	
Driving	69 in.
Front truck	33 in.
Trailing truck	44 in.
Journals, diameter and length:	
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Grate area	70.8 sq. ft.
Heating surfaces:	
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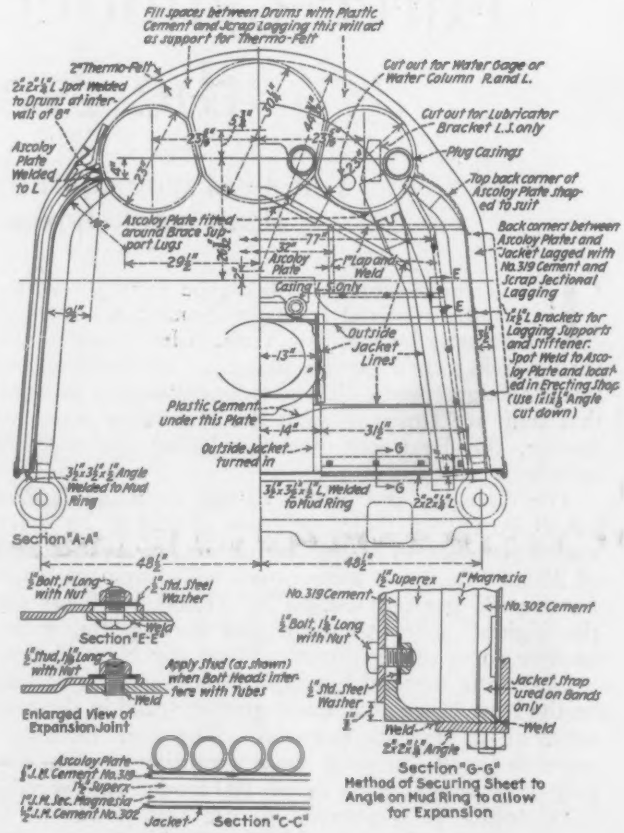
Firebox heat. surface ÷ grate area	6.37
Firebox heat. surface, per cent of evap. heat. surface	11.2
Superheat. surface, per cent of evap. heat. surface	42.9

scribed on page 533 in the August, 1927, issue of the *Railway Mechanical Engineer*, is designed to eliminate air leaks and to facilitate the application and removal of front end netting and deflector plates. Instead of being made of rolled steel plates, shapes, etc., it is cast in one piece, thereby giving simplicity and strength, also absence of air leaks so detrimental to fuel



A cross-section of the firebox and some of the details showing how the lagging is applied

economy. The smokebox also includes lugs at the front and back which are tightly fitted to flanges on the cylinder which is, in turn, further locked to the smokebox by similar flanges and keys welded in place. This

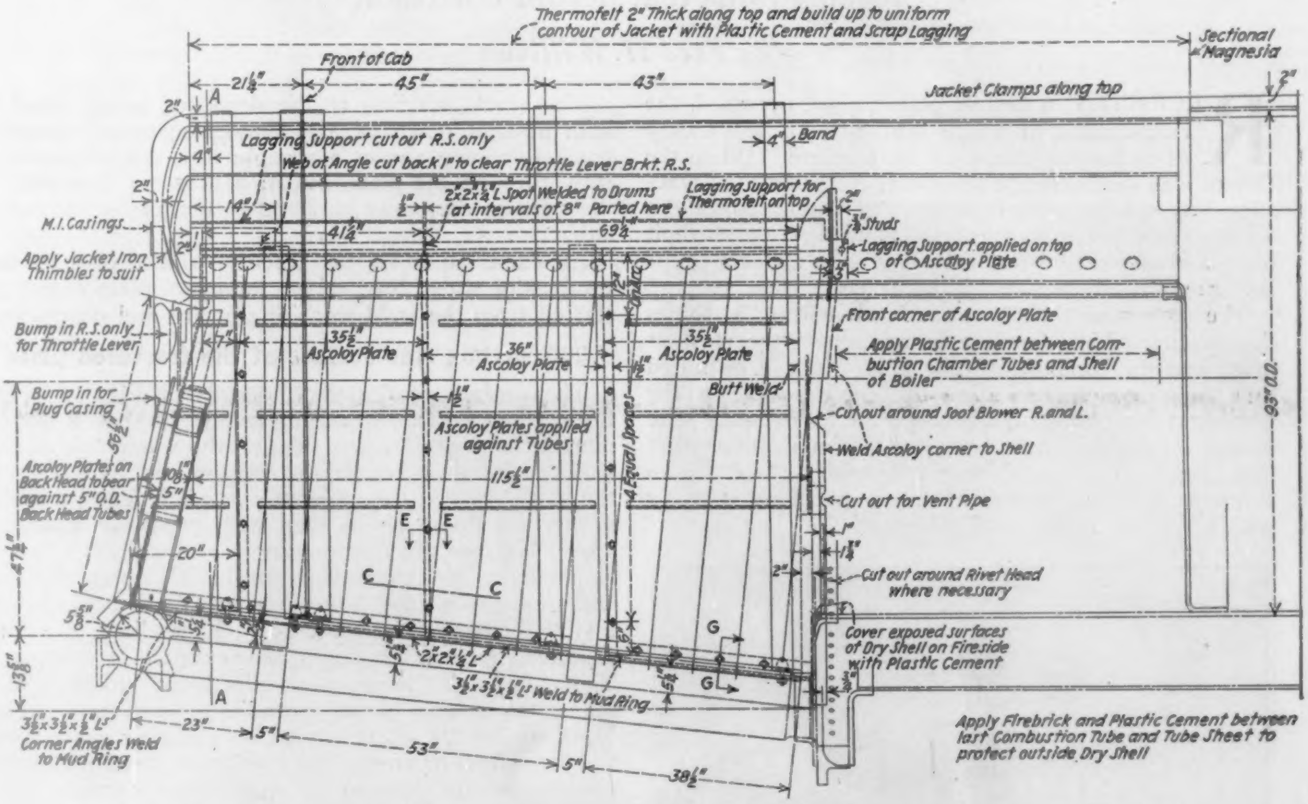
The front end with its various brackets is cast in one piece

scheme insures positive and constant alinement of the frames and the maintenance of the correct position of wheels, axles, boxes, guides, valve motion, etc., thus tending to reduce maintenance costs.

Instead of the usual angles that are bolted to the inside of the smokebox, with the bolt holes causing air leaks, the small integral lips will receive the interlocking front end arrangement, which can be applied and removed in about one-third of the time needed for the removal of the older arrangement.

The running gear follows the previous locomotives of this type, the New Haven's standard being used wherever possible. The Commonwealth engine truck is used, the engine truck boxes being provided with the removal type of hub liner. The front drivers are provided with lateral motion boxes. The outside main rods connect the No. 4 and the inside main rod to the No. 3 wheels. The main rods have solid front end bushings and floating back end bushings. The side rods have floating bushings in the middle connection in accordance with the New Haven's standard. All pin connections in the spring rigging and brake rigging are fitted with case hardened bushings. The Commonwealth delta type trailing trucks are used, with floating hub liners at the trailer wheels.

Care has been taken with the piping and back head arrangement to secure a pleasing appearance. All the piping possible, including sand traps and piping has been placed under the jacket. Where piping could not be placed under the jacket, care has been taken to run the piping along horizontal and vertical lines as far as possible. All steam pipes and valves, as far as possible, have been kept outside the cab under a turret housing over the top of the boiler in front of the cab. The steam valves in the turret are operated by extension handles which pass back through the cab where they are arranged in a neat line across the top of the firebox on a control board with each handle clearly labeled. With the exception of the air and back pressure gages, all of the gages are mounted in a straight line arrangement on an instrument board.



By using Ascoloy plates and four layers of lagging and cement, the firebox is completely sealed

Among the special equipment included on these engines are feedwater heaters, automatic train control, force feed lubricators, air operated whistles, automatic bell stops, soot blowers, stokers and multiple throttles.

A folding door in the side of the tank provides access to the engine compartment for inspection and repairs.

The tenders are of the rectangular type, having a capacity of 18 tons of coal and 16,000 gallons of water. They are carried on Commonwealth six-wheel trucks, fitted with the clasp brakes.

* * * *

Interior of Machinery Hall at the Leipzig Trade Fair—This fair is held annually and is international in scope

Firebox plate failures

Theory advanced that use of air hammers on plates sets up metal strains that permit corrosion

By Fred H. Williams

RECENTLY, a firebox plate failure occurred, the examination of which resulted in a new theory as to possible cause of the fracture. When the failure was discovered, a specimen, containing the fracture, was cut from the side sheet of the firebox about 12 in. from the mud ring; it included three staybolt holes and one combustion tube hole with about 3 in. of the sheet on either side of the fracture.

The section of the plate, as shown in Fig. 1, shows the location of the fracture in relation to the staybolt holes and the combustion tube hole. It will be noted that the crack extends from the staybolt hole at the bottom of the photograph through the intervening plate to the combustion tube hole, up to the next staybolt hole, where it stops. The crack runs vertically with reference to the firebox chamber and longitudinally with reference to the final rolling of the plate.

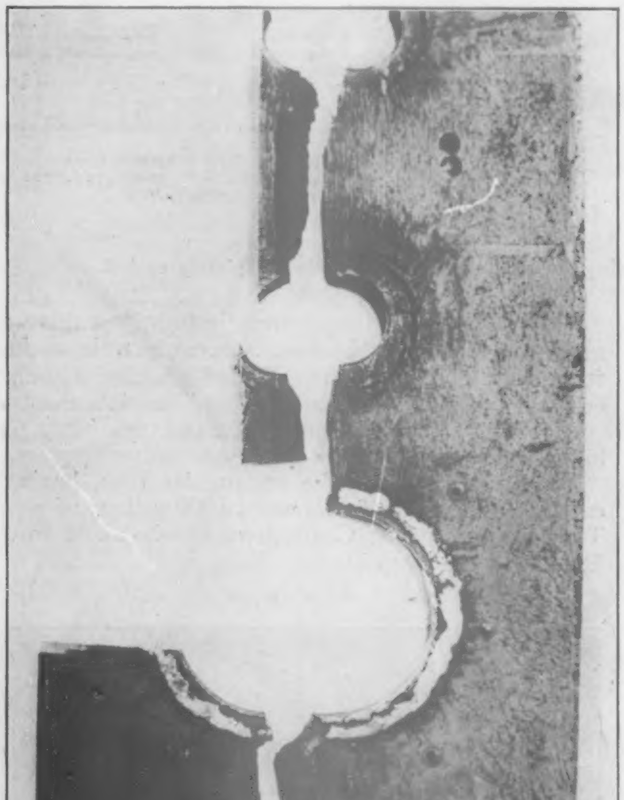


Fig. 1—A piece of the side sheet plate showing the fracture —The view shows the firebox surface

The crack started, in this case in the weld, where the combustion tube was welded to the inside side sheet and worked both upwards and downwards from the upper and lower edges of the hole to the two staybolt holes on the top and the one on the bottom of the section of the plate shown.

The crack, starting at the deposited metal, worked both up and down as a rapidly progressing creeping crack following almost a straight line, not perpendicularly through the plate, but in a diagonal direction to the right in the upper half and to the left in the lower half.

An examination of the fracture of the plate at the combustion tube hole edges indicates plainly that it started from the weld working upward and downward.

The firebox side surface of the fractured plate

The surface of the plate, shown in Fig. 1, is the firebox side and is most interesting in that it shows more extensive corrosion than on the water side of the sheet, and corrosion of a different nature. Looking at the plate between the upper two staybolt holes, a series of vertical lines can be seen with gradually widening spaces between them at the center, and while not shown as plainly in the picture between the other staybolts and the combustion tube hole, they are there nevertheless and on both sides of the crack. These lines are comparatively narrow but deep grooves caused by corrosion. The pattern of the grooves collectively, indicates that the metal is in a strained condition over these areas. Moisture for the corrosive action probably came from leaky staybolts or from condensation of steam and moisture of the air entering through the combustion tube. The grooves are really narrow pits following the strain

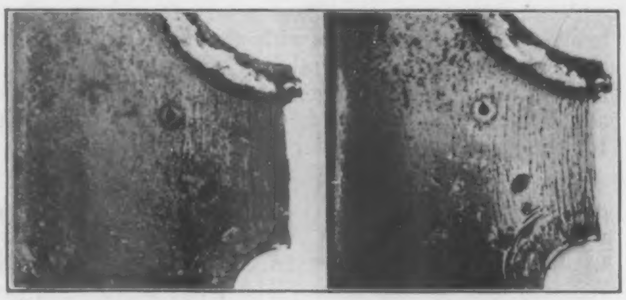


Fig. 2, Left—This view shows the strain lines and pitting of the plate between the staybolt hole and the arch tube hole; Fig. 3, Right—The same as Fig 2, but polished to intensify the lines

lines and are made by the eating away of the metal through electrolytic action. The energy for this action is obtained through differences of potential of the strained and unstrained crystals of the steel. The electrolyte is made up of the moisture previously mentioned and gases from the fire. The fracture follows the strain lines of the shortest length. Thus, the fracture occurs between the staybolt holes and the combustion tube hole. The fracture starts from the coarse grained metal of the weld at the combustion tube hole and works down from the lower edge and up from the upper edge of the same hole. The slope of the fracture is probably due to the slant that the welder gave to the electrode in depositing the metal, and its freezing into long slanting grains, thus affording a weaker path than

straight through the plate. The fracture follows the grooves on the firebox side caused by the corrosion, and along the short vertical strain lines between the staybolt holes, and between them and the combustion tube hole. As the pits are deep and continuous on the firebox side, the crack follows for the most part the original direction as set by the starting cracks from the deposited metal of the weld.

In order to make a closer study of the pitting, two photographs are shown of the piece of the plate located in the lower left hand corner of Fig. 1. The first is shown in Fig. 2, which gives more definition to the lines in the untouched plate. The pits can be seen faintly as rust streaks; they appear as lines of rust and they are. Looking at this piece of plate when it is cleaned and the surface slightly ground, these lines of rust are brought out more clearly as is shown in Fig. 3. We now have a real picture which shows the strains that

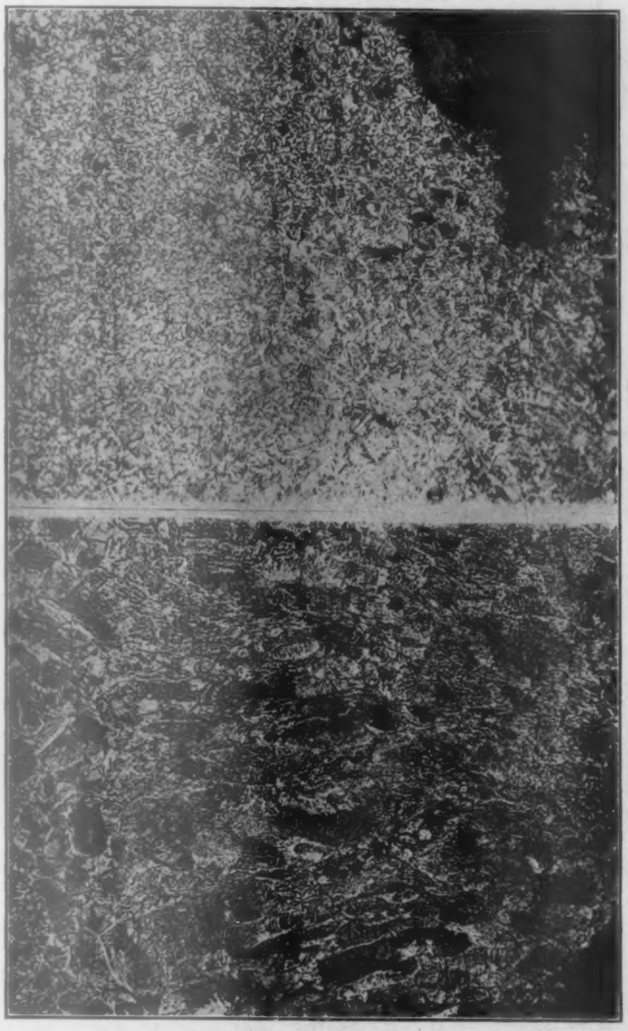


Fig. 4, Top—The structure of the steel at and near where the arch tube was welded to the plate—The parent metal to the left and the deposited metal to the extreme right; Fig. 5, Bottom—The structure of the weld and the parent metal at the outer edge of the bead shown at the lower right corner

were in the plate, as the rust followed the strain lines and developed comparatively deep narrow grooves along them.

The reverse side of this plate does not show quite the same picture. The rust pits are partly of a different nature and are not so numerous nor are they in the same formation. The formation is more complicated and less clearly interpreted.

The welded-in combustion tube

It is probably hardly fair to place the blame entirely on the welded-in combustion tube. Similar cracks and failures take place in sheets without any welds in sheets near the location of the crack. In fact, it is quite within reason to believe that the corrosion pits would have

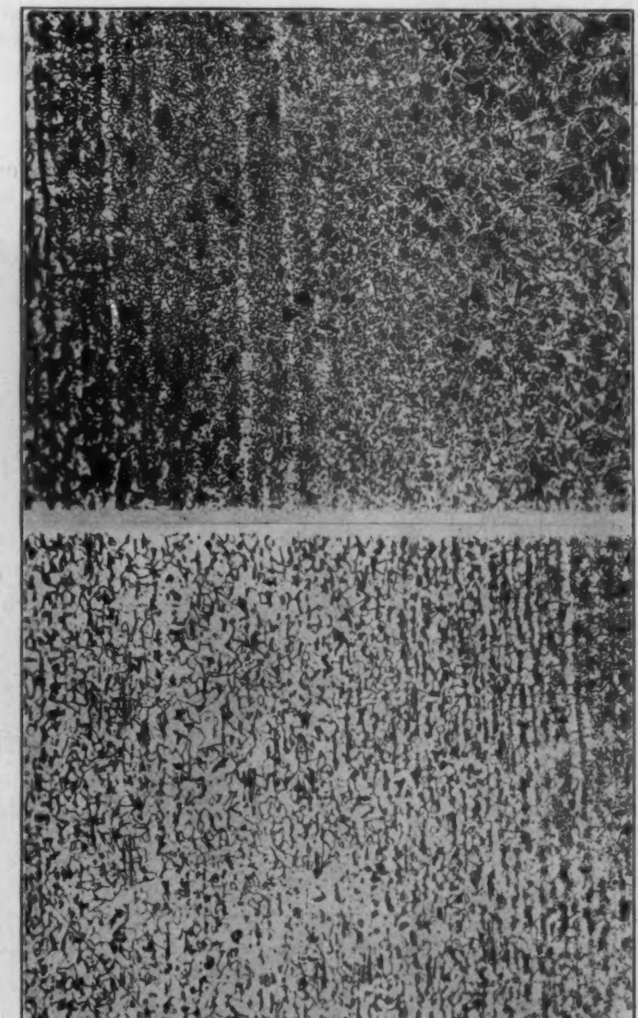


Fig. 6, Top—The heat affected the metal structure to the right and the parent metal to the left is nearly the original structure; Fig. 7, Bottom—This shows a continuation of Fig 6

caused the crack in time, even though not assisted as it was at the start, by the welded-in combustion tube.

A study of the weld will show wherein it is weak, and also the line of failure. The part of the deposited metal adjacent to the combustion tube may be seen in Fig. 4. It is very good.

The coarse grain of the deposited metal and the overheated parent metal is shown in Fig. 5. In this view, the lower right hand corner shows the edge of the bead of deposited metal, which shows good penetration. The very long narrow crystals or structure is shown at the right and at the left is the finer structure of the parent metal that was near the overhead plate near and at the edge of the crater of the arc.

Fig. 6 show the structure of the metal further away from the crater and the commencement of the original structure of the plate. The plate is of the best open hearth acid firebox steel, ⅜ in. thick.

Next along the path from the weld inward, we come to the junction of the structure shown in Fig. 6, and the original material. This is shown in Fig. 7, where the center and left half of the photomicrograph show no effects from the weld. It is interesting to note that the metal is very clean and nearly free from ghost lines which are more numerous in the central portion of the plate; likewise included slag or non-metallics are very few and of short lengths, narrow and of practically no consequence. The weld was on the face of the plate and the heat affected portion extended barely into the less fine inner zone of the plate.

Corrosion pits

The next two photomicrographs show the pits on the firebox side of the plate and the structure of the steel in the surface zone of the plate and the central zone.

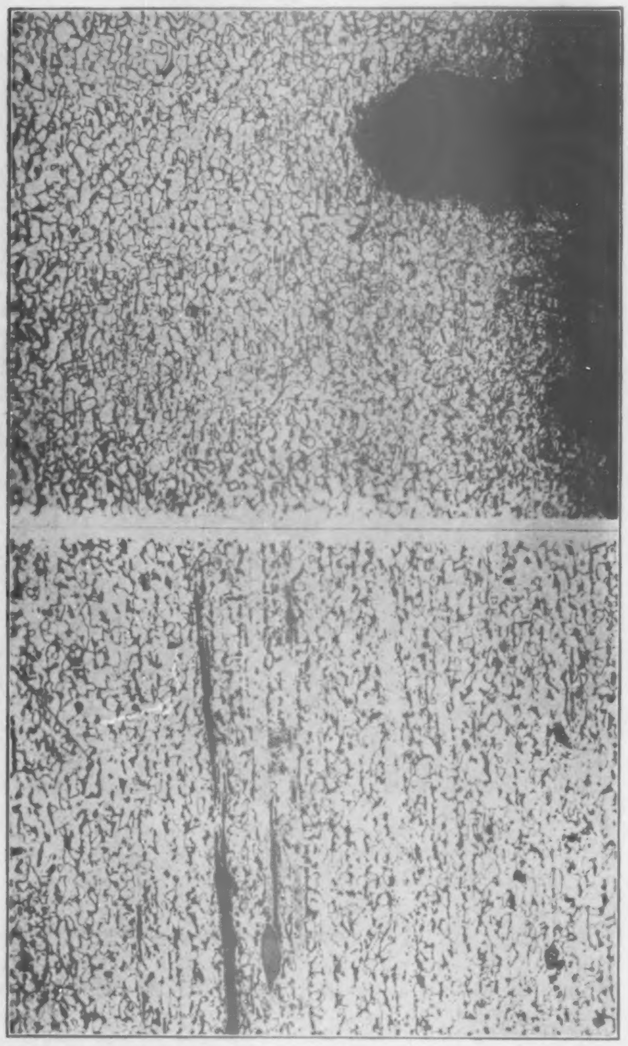


Fig. 8, Top—The black represents one of the pits or grooves eaten out by corrosion on the firebox side of the sheet; Fig. 9, Bottom—The structure of the central portion of the plate

In Fig. 8, we see some of the pits; one is very deep, comparatively speaking, and one or two just starting. The deepest pit is just .0175 in. deep and .01 in. wide—deep enough to mark the line of the fracture. Just an ideal nick in the plate to start a failure. Note the uniformity of the structure of the steel and the fineness of the grain, also the absence of any crack at the bottom of the pit. The pit is, plainly, rust eating into the metal and not a crack. The corrosive action is hastened by the difference of potential of the crystals causing current to flow from one crystal to the other, breaking up the metal and causing the deep pits.

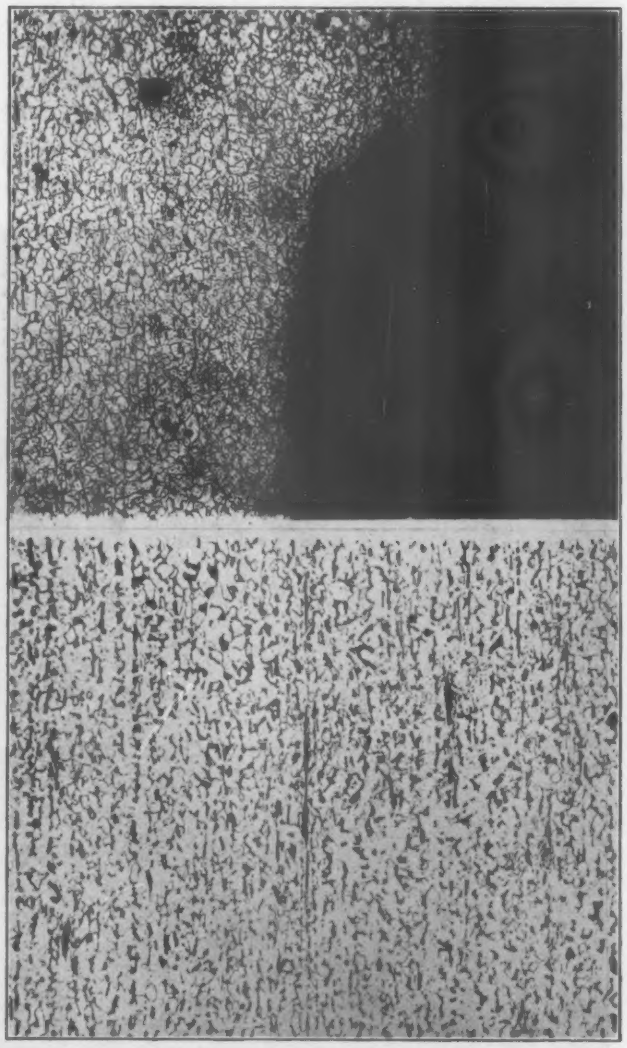


Fig. 10, Top—This shows one of the pits in the plate on the water side of the sheet; Fig. 11, Bottom—The cross-section of the plate near the center

In Fig. 9, the small impurities are seen. The dark band is almost too small to note—a little overetched—it is in reality similar to the light gray spot to the left. It is very thin, not more than .01 in. in lengh. Note the few ghost lines including these impurities and also some that are very free from such impurities as appear elsewhere. The grain structure shows careful rolling and finishing at a proper temperature.

The corrosion on the inner or water side of the firebox side sheet is shown in Fig. 10. Most of these pits are not so deep, but they are much wider and of more rounded areas than those on the firebox side. Then follows a section of the central portion of the plate which is longitudinal to the direction of the rolling of the plate which is the direction when the billet is first

put on the rolls. A few passes are made and the lines developed along in one direction. These are then widened somewhat when the plate is rolled at right angles to the first few passes. The structure is of a fine, uniform grain size and with very few non-metallic areas.

Test pieces

A test piece, ½ in. in width, was cut off the top portion of the plate, which included the pitting along the surface between the staybolt holes. An examination of the fractured test piece shows a series of cracks that do not run very deep. The cracks are more on the firebox side of the side sheet. The fracture underneath the surface and out of the influence of these cracks is of a fine uniform structure.

Physical characteristics of test cut off top portion of fractured plates

Tensile strength, lb. per sq. in.	72,250 lb.
Yield point, lb. per sq. in.	64,400 lb.
Elongation in two inches	17.5 per cent
Reduction of area	31.3 per cent

A longitudinal test piece, 1 in. wide. was also cut vertically. Figs. 11 and 12 show these two test pieces.

Conclusion

The writer has endeavored to show the inside nature of the failure in combination with the outside features and has pointed out that, while the weld helped at the start of the fracture, the real cause for the final fracture was the corrosive action of impure water on the strained metal between the staybolt holes. These deeply penetrating corrosion pits that collectively united into grooves along the strained metal marked and facilitated the path of the fracture. The effect is the same as nicking any piece of steel and then subjecting it to a sudden strain which would result in a failure. Similar pits and grooves extended down the tapped staybolt holes and were deeper to some extent due to the erosive action of the leaking water. These small leaks of the staybolt pits providing proper conditions, as in this instance, resulted in a dangerous crack and the removal from service of a locomotive.

The writer's theory of the failure

It will be seen, by examining Fig. 3, that the grooves

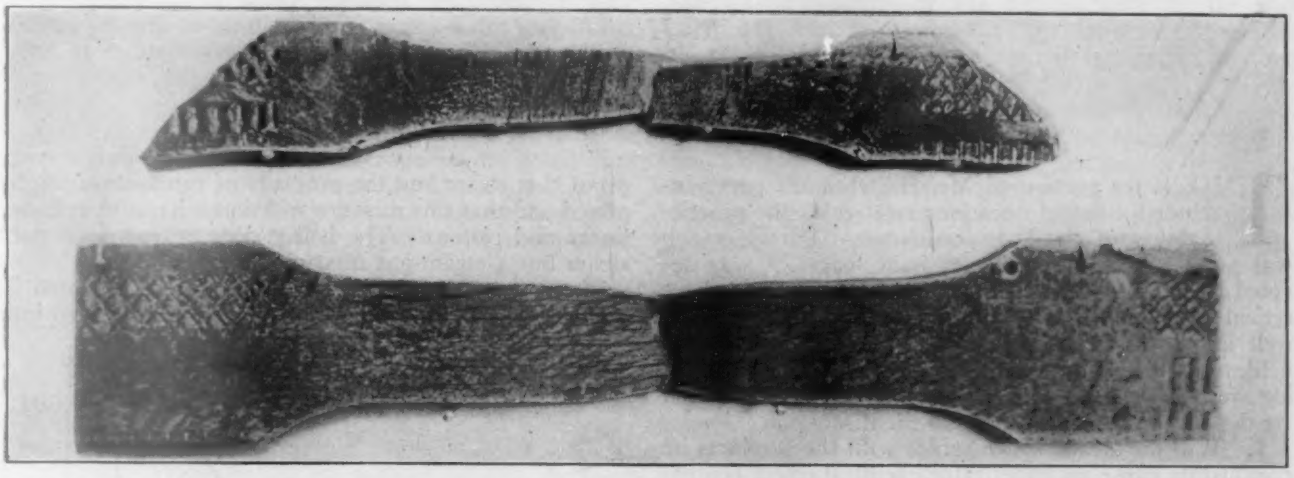


Fig. 12, Top—The test piece, after fracture, showing the water side; Fig. 13, Bottom—The test piece after fracture showing the firebox side of the sheet

from the plate shown in Fig. 1, to the left of the photograph. This test piece, upon fracture, shows only the cross-section of the pits. The cracks show up faintly longitudinal to the test piece. The continuous pitting apparently runs vertically even between the vertical lines of the staybolt holes.

The following are the physical properties of the longitudinal test piece.

Tensile strength, lb. per sq. in.	67,665 lb.
Yield point, lb. per sq. in.	54,750 lb.
Elongation in five inches	17.5 per cent
Reduction of area	55.0 per cent

These figures differ considerably from those from the same plate when rolled. The following are the physical properties of the plate as rolled:

Tensile strength, lb. per sq. in.	57,700 lb.
Elongation in eight inches	32 per cent

Chemical analysis of the plate when new: Carbon, 15 per cent; phosphate, .035 per cent; manganese, .44 per cent; sulphur, .028 per cent.

The analysis of the plate when failure took place is practically the same. The carbon content of the plate is one point less.

The grooves caused by electrolysis causing a corrosive action on the plate, run vertically and not horizontally to the side sheet and thus weaken the sheet made by the corrosion follow a pattern wherein the staybolt holes are the nodes of a series of wave lines which reach their maximum amplitude between the staybolt hole and the combustion tube hole.

It appears to the writer that the air hammers, used in the fabrication of the firebox, are the cause of these strains in the metal and the subsequent corrosion pitting. The use of the hammer on the outside and a dolly on the inside, will undoubtedly set up these strains. The practice of using the hammer on the inside will undoubtedly increase these strains. With an air hammer on each end of the staybolt and operating at the same time, the blows will seldom synchronize and thus double the strains.

The plate metal is not burned nor overheated except at and near the weld, where the crystals are somewhat coarsened owing to the overheating of the metal adjacent to the line of the weld.

Attention is called to the change in the physical properties of the plate before fabrication and after service at the time of the failure. The service has increased the tensile strength and reduced the elongation considerably. There is no apparent change in the structure of the steel in the plate that would lead one to say that the metal was overheated; neither is the

grain of the steel anything but very fine and uniform.

About .01 in. in from the surface of the firebox side of the plate, the writer noticed a slight decarbonization of the steel and between this narrow band and the surface the steel was of a higher carbon content. This band was about .002 in. in width. This slight change does not appear to the writer to be of any special consequence except that it indicates that the metal has been but slightly changed and that only by a moderate temperature for some length of time rather than at an intensive heat.

Recommendations

Experimental tests should be made to ascertain whether the spinning of the staybolts in the fabrication of the firebox would benefit or remove entirely the failures similar to the one just described.

When further failures take place, a section of the crack enclosing two or three staybolt holes should be ground slightly and examined to corroborate the lines in the failure. The patterns made by the rust following the strain lines should be studied and thus ascertain the cause of these strain lines and the remedy. A study should be made to ascertain why a change of physical properties takes place through service and without excessive overheating of the plate.

Probably these recommendations are already being carried out by some of the readers and perhaps they would be glad to enlighten those not so fortunate.

Diesel engines for locomotives*

Practicability of the proposed Diesel-steam locomotive is discussed by the A. S. M. E.

By R. Hildebrand

Chief engineer, Diesel department, Fulton Iron Works, St. Louis, Mo.

Part II

THE latter portion of Mr. Hildebrand's paper included a list of questions relative to the practicability of the D-H locomotive. Part I, which was published in the February issue, page 79, was devoted to a description of the proposed design and theoretical characteristics. Quite a number of engineers, well known in both the Diesel and steam locomotive field, took part in the discussion of this paper. Following are the questions together with the answers prepared by the author and a summary of the discussion.

1. Will the steam which mixes with the products of combustion cause an undesirable chemical effect (corrosion) on the cylinder walls?

In an ordinary Diesel, the products of combustion contain a considerable amount of steam (caused by the hydrogen and hydrocarbons in the fuel oil) which does not affect the cylinder walls whatever.

Another proof that the steam and the products of combustion in the proposed D-H locomotive will not cause difficulties is furnished by the performance of the Still engine. In this engine, while the piston travels, gases will blow by the piston into the steam space because no piston holds perfectly tight, and many leak badly.

The most convincing proof that the admission of steam to the working cylinder of the Diesel will not be harmful are the experiments of Professor Hopkinson in which water was injected into the power cylinder of a producer-gas engine to eliminate the external cooling. The author wishes here to quote Professor Hopkinson's own words: "It (the engine) is giving no trouble at all and has been working regularly for two years, the total time of running being 5,000 hours. Anthracite coal is used in the producer, and the coal contains a considerable portion of sulphur, yet there has been no trace of corrosion."

The internal-combustion boiler furnishes a further proof that steam and the products of combustion can be mixed and that this mixture will do no harm to cylinder liners and pistons. The boiler does not produce pure steam but a steam-gas mixture.

If the internal-combustion boiler can be operated in the manner described, and if water can be injected into

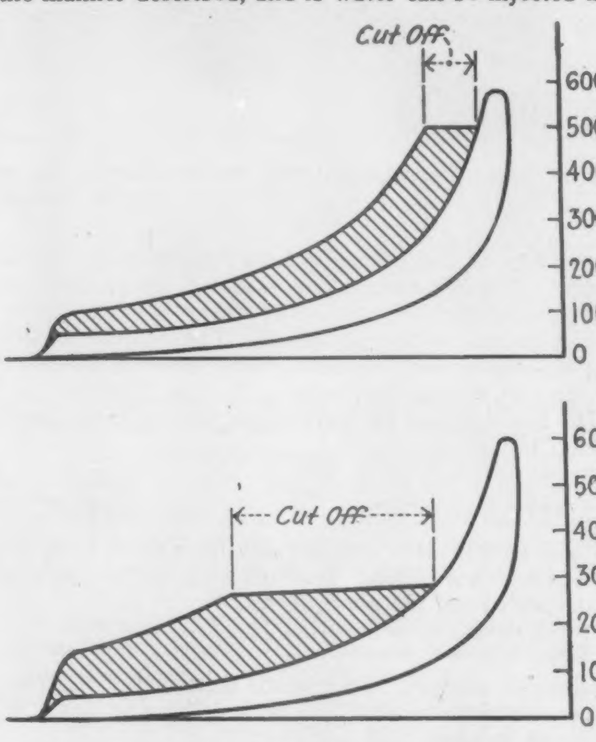


Fig. 1—Indicator cards showing the advantage of high pressure boilers for the D-H locomotive

a cylinder of an internal-combustion engine, and if the Still engine is practical, then it is unquestionable that highly superheated steam may be admitted into a hot

* Abstract of a paper contributed by the Oil and Gas Division for presentation at the annual winter meeting of the American Society of Mechanical Engineers, December 5 to 8, 1927.

Diesel cylinder without causing material difficulties.

2. What will be the boiler pressure?

Since the working cylinders must be designed for 550 to 600 lb. initial pressure, it is highly advisable to use also a high boiler pressure, say 500 lb. gage. Fig. 1 will illustrate this. Both cards show an auxiliary power of just 100 per cent, but the cut-off is much shorter and consequently the economy much greater with the auxiliary power medium of 500 lb. than with the low pressure shown.

3. Will not such a high boiler pressure cause difficulties?

It should not if the boiler is designed for such a pressure. In stationary practice, boiler pressures of 300 to 400 lb. are quite common; also 500 lb. is frequently used. Even 1,200-lb. pressures have been successfully tried. All these high-pressure boilers are of the water-tube type. Similar boilers may be installed within the space and weight limits of a D-H locomotive as the boiler capacity required is only about 60 per cent of that which is now used in connection with standard steam locomotives.

4. All high-pressure boilers have small drums and consequently small water contents with only a very limited amount of heat stored up in the water. Will this heat, in connection with the combustion in the boiler, furnish sufficient steam to start and to accelerate the train?

While it is true that the tractive force required to start a train is great, yet the average engine speed during the starting period is small. Consequently, the corresponding horsepower is small. This explains why the limitations on the boiler capacity of the present steam locomotives are mostly felt at higher speeds, while during starting there is ample boiler capacity but not always sufficient adhesion between the wheels and the rails. Therefore a small boiler will be sufficient to start the train and to accelerate it up to a speed of about four miles per hour. After that speed is reached, the Diesel begins to fire and relieves the boiler.

Here it should be mentioned that the D-H locomotive will begin to fire at a lower speed than the ordinary Diesel engine because the former uses superheated steam and the latter cold high-pressure air as a starting medium. Superheated steam heats the cylinders, while the expansion of cold air has a chilling effect which makes starting difficult.

There may be conditions when a boiler with a large water volume is desirable, as for instance in mountainous regions. In order to obtain, when conditions demand it, a large water volume, a few additional water drums may be attached to the boiler. A high-pressure boiler with additional water drums is shown in Fig. 2.

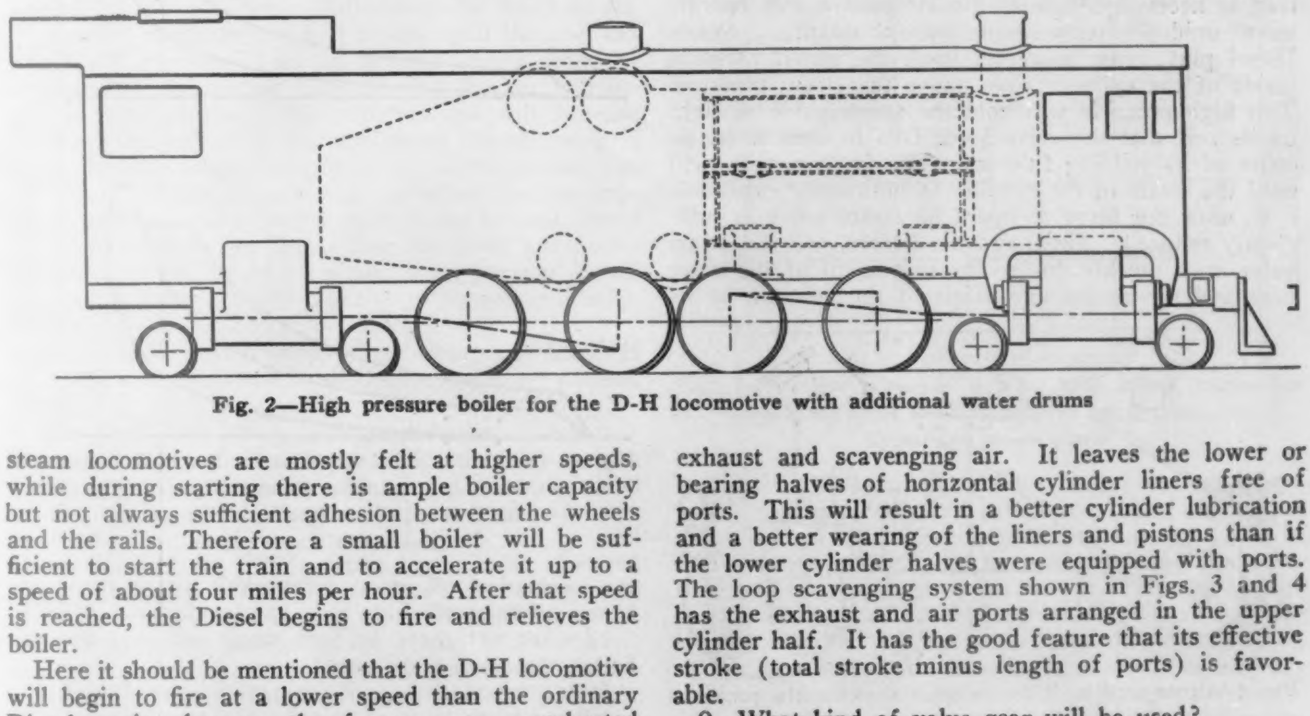


Fig. 2—High pressure boiler for the D-H locomotive with additional water drums

5—Will not the cost of maintaining the boiler be a considerable item?

The rate of combustion has a deciding influence on the maintenance of a boiler. While it is true that the boiler of the D-H locomotive will be kept permanently under full steam pressure to be ready at all times to furnish auxiliary power, steam will nevertheless be used very sparingly, and seldom up to the full boiler capacity. Using Diesel power most of the time, and steam power only intermittently, the cost of maintaining the boiler will be less than that experienced with the present steam locomotives with their high rates of evaporation.

6—What kind of fuel will be used for the boiler?

The most convenient fuel will be the same as that used for the Diesels. The commercial more than the engineering point of view will decide this question.

7—Why will Diesels of the solid-injection type be used?

It is advisable to use them because injection air would cause too great a chilling effect in the combustion chamber. Consequently, if the Diesel were of the air-injection type, it would require higher speed before the firing would take place than if it were of the airless-injection type.

8—What scavenging-air system will be used?

The loop scavenging system will be found most convenient for locomotive purposes because it permits a long stroke and the arrangement of the exhaust and scavenging ports on the same cylinder side. This arrangement also provides convenient passages for the exhaust and scavenging air. It leaves the lower or bearing halves of horizontal cylinder liners free of ports. This will result in a better cylinder lubrication and a better wearing of the liners and pistons than if the lower cylinder halves were equipped with ports. The loop scavenging system shown in Figs. 3 and 4 has the exhaust and air ports arranged in the upper cylinder half. It has the good feature that its effective stroke (total stroke minus length of ports) is favorable.

9—What kind of valve gear will be used?

The Walschaerts, or any other established reverse gear, may be used. The valve gear has to control only the steam inlet with a variable cut-off. The exhaust and the scavenging air are controlled by the ports. This makes a favorable valve gear.

10—How will the steam inlet valve be made to open just when the gases are expanded to a pressure substantially equal to the steam pressure?

Figs. 3 and 4 will make this clear. These show a

preliminary design of a working cylinder and part of the valve gear. The cylinder greatly resembles a uniflow steam cylinder, while the combustion chamber resembles the well-known "A" type Diesels of the former American Diesel Engine Company, which engines have

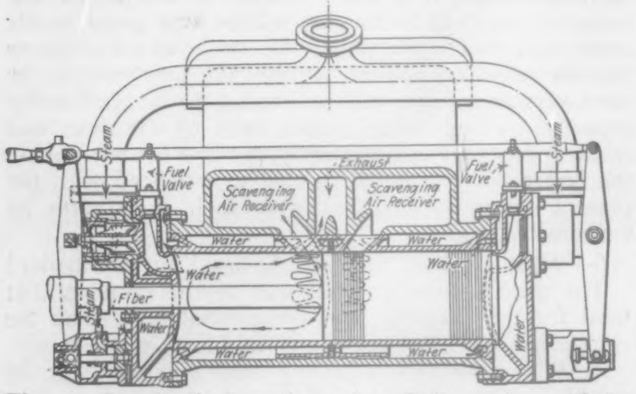


Fig. 3.—Longitudinal section of a D-H engine cylinder showing the loop scavenging system

now been in operation for about 18 years with a record of good combustion.

The valve shown is equipped with a piston at its outer end. The steam pressing on the valve head and its piston, always tends to close the valve and to hold it tight against its seat. The fulcrum of the valve lever is fastened to a small piston, on which the steam presses.

The valve gear tends to open the steam valve slightly ahead of the dead-center position. This (constant) lead is necessary because the locomotive will operate as a uniflow steam engine while starting. When Diesel plus steam power is used, the initial pressure inside of the cylinder rises above the steam pressure. This high pressure will hold the steam valve so tight on its seat that the valve lever fails to open it on account of its yielding fulcrum. The fulcrum will yield until the steam in the cylinder is sufficiently expanded, i. e., until the force to open the steam valve is sufficiently reduced. Then, and not before, will the steam valve open quickly due to the movement of the valve gear and the return movement of the fulcrum by its

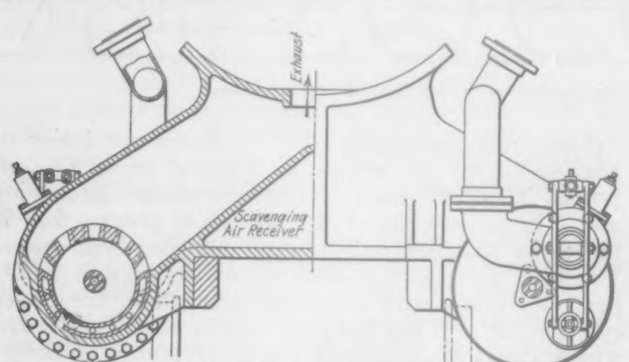


Fig. 4—Cross section of the cylinder showing the proposed loop scavenging system

steam-loaded piston. Selecting a suitable size of the fulcrum piston, the steam valve will open in proper time to obtain a card substantially as shown in the lower card, Fig. 5. When no steam is used, the steam throttle will not be closed, but the steam on the pistons attached to the fulcrum of the valve levers will be turned off. This will prevent the steam valves from opening.

11—Are the high initial pressures, which are characteristic of the Diesel cycle, permissible in railroad engineering?

To avoid excessive forces, four small cylinders instead of two large ones may be used, as shown in Fig. 2. These small cylinders will drive the axles directly, and their forces will not exceed the piston forces now obtained with ordinary steam locomotives. Consequently, the piston rod, crosshead, connecting rod, pins, and axles will be of the same size as now used in railroad practice.

Instead of using four cylinders, only three or two may be used if they drive through one set of reduction gears as shown in Fig. 6. There is sufficient room to arrange three cylinders within the available space. Using a reduction gear, which only very slightly lowers

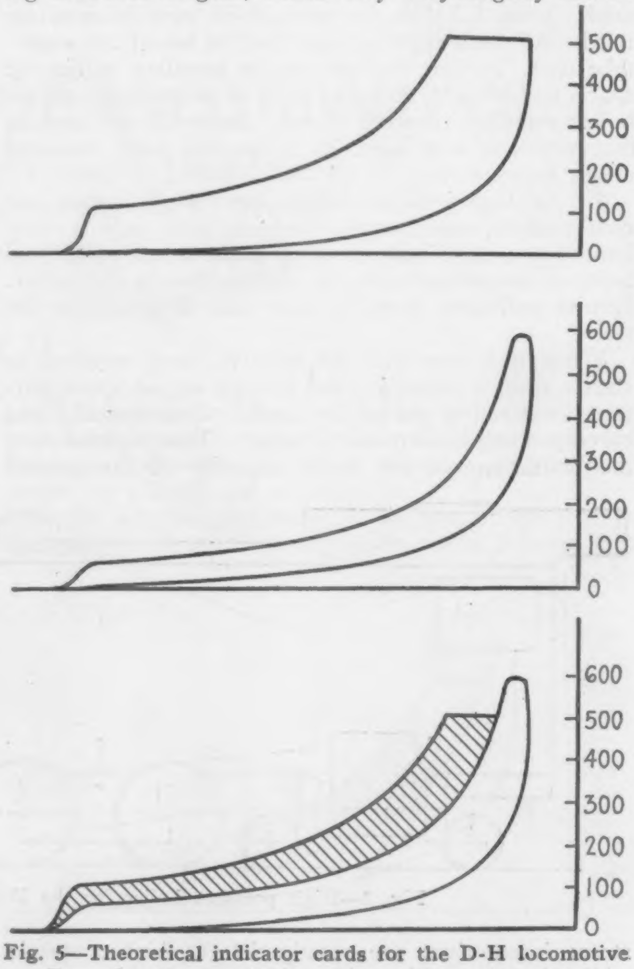


Fig. 5—Theoretical indicator cards for the D-H locomotive. Top—Starting conditions; Center—Operating under full Diesel power; Bottom—Using both Diesel and steam power

the mechanical efficiency, a favorable piston speed and a convenient stroke-bore ratio can be chosen.

12—Are not three or four small cylinders less efficient than two large ones?

It is one of the good features of the Diesel that small cylinders give practically the same thermal efficiency as large ones. So with steam, when it expands in hot Diesel cylinders where no condensation will take place, the cylinder size is of minor importance.

13—Will a three, or four-cylinder locomotive, with its greatly increased reciprocating masses, run just as smoothly as one with only two cylinders?

Using three cranks, the reciprocating masses are balanced more effectively than when using only two cranks.

When using four cylinders (two on each side, see Fig.

2) and opposed piston travel, perfect balancing of the masses can be obtained, which is impossible if only one cylinder on each side is used.

14—Is it practical to instal a booster as is done in the standard steam locomotive for raising the tractive force while starting?

The installation of a booster on a D-H locomotive is just as easily accomplished as in a standard steam locomotive because the booster may be steam driven.

15—Will it not be quite complicated for the engineman to operate the locomotive as outlined in the preceding paragraphs.

The whole control on the locomotive will be accomplished by two levers. One will operate the reversing

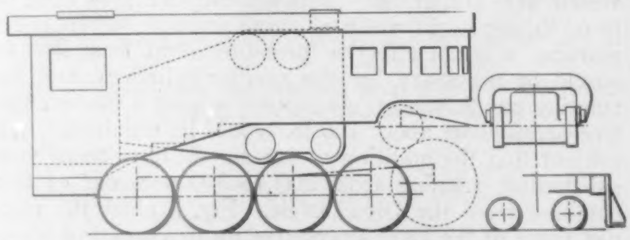


Fig. 6—Arrangement for driving the D-H locomotive through reduction gears

gear in the usual manner. The other lever, when moved into the starting position, will permit steam to enter the cylinders. While this lever is held in the starting position, no fuel will be delivered to the working cylinders. When the control lever is turned into the first notch (i. e., when the Diesel begins to fire) the steam is turned off, and a small amount of fuel will be delivered to the cylinders. Advancing the lever to the next notch increases the fuel supply until the fuel delivery will correspond to the normal Diesel rating of the engine. Advancing the lever still further will begin to admit steam to the cylinders and will increase the fuel delivery until the maximum Diesel rating is reached. The engineman, with this arrangement, can use steam only during starting and when the fuel supply is reached which corresponds to the normal Diesel rating. There is no danger that the D-H locomotive will be operated by steam power alone because it will not have sufficient boiler capacity to be operated satisfactorily.

16—What are the principal disadvantages of the D-H locomotive as compared with the existing railroad engines?

The D-H locomotive requires a boiler. This may be considered a disadvantage, while in reality it is a more desirable means for obtaining the needed load on the driving wheels than an indirect drive and other auxiliaries required in connection with the present Diesel locomotives. This refers to main-line locomotives. It is the boiler with its stored-up energy and with its combustion which is ready at any moment to furnish auxiliary power to the Diesel when starting and when climbing steep grades. It is the boiler which protects the Diesel from being overheated. It is the boiler which enables the locomotive to furnish tractive forces which, at all speeds, will be equal to or higher than those of the present steam locomotives. It is the boiler which makes the D-H locomotive adaptable to main-line purposes. On the other hand, it is the indirect drive of the present Diesel locomotive which complicates the engine, causes high initial cost, great total weight, too light a locomotive for heavy duty, great reduction of the total mechanical efficiency and undesirable tractive forces at higher speeds. Thus, it is the indirect drive which makes the present Diesel locomotive undesirable for mainline service.

Discussion

In discussing Mr. Hildebrand's papers, A. Lipetz, consulting engineer, American Locomotive Company, stated that if the experience with the Still locomotive in England should prove that the proposition of a combination of Diesel and steam for railway traction is practical, we may hope to see the D-H locomotive built in this country. It would be a mistake, he pointed out, in considering the use of steam in a locomotive, to treat it from the point of view of power instead of tractive force. The statement in the paper that "With working cylinders of just sufficient volume to develop enough Diesel power to meet the average power demand, the D-H locomotive will operate as a pure Diesel most of the time" is somewhat misleading. A direct driven Diesel locomotive he said, becomes a constant torque locomotive instead of a constant power machine as it is in the case of intermediate transmission. The constant torque locomotive must be designed to correspond not to the average but to the minimum torque, or a torque very close to the minimum, otherwise the smaller tractive force, for the Diesel engine will be considerably underloaded and the economy of the Diesel prime

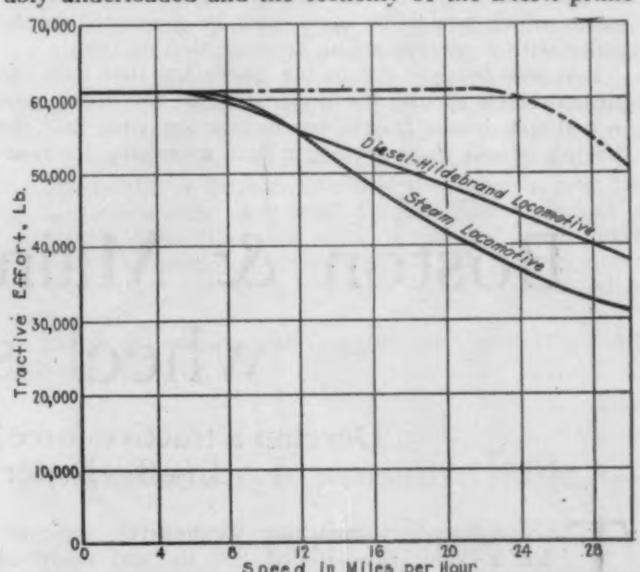


Fig. 7—Tractive force of a 2-8-2 type steam locomotive compared to the D-H locomotive using combined Diesel and steam power

mover will be reduced. As the torque variation in a locomotive, on account of different railroad conditions, varies from 1 :4 to 1 :6, the addition of steam power to Diesel power, which will be required, may go up to three to five times that of the Diesel. This, Mr. Lipetz said, would turn a Diesel-steam locomotive into a steam locomotive with the addition of Diesel cylinders working all the time with both oil and steam which is contrary to Mr. Hildebrand's supposition that the locomotive will operate as a pure Diesel most of the time. Efficiency of such a locomotive is correspondingly dropped and may not be over 10 to 12 per cent as an average, which represents an improvement over a steam locomotive that may not justify the application and the use of oil when coal is available.

Continuing, Mr. Lipetz criticised Mr. Hildebrand's answer to the first question. He said that the ideas worked out from Professor Hopkinson's tests had been suggested and tried by various experimenters, but had

never become generally accepted and at the present time all our internal combustion engines are cooled by outside jackets. Mr. Hilderbrand's reference, therefore, is not convincing. Neither did Mr. Lipetz consider as pertinent Mr. Hildebrant's reference to the Brunler internal combustion boiler as this boiler is in a very preliminary stage of development and no practical results with the use of steam and the products of combustion in engine cylinders have so far been developed. We do not, he said, know whether this mixture will affect cylinder liners and pistons in the long run.

Mr. Lipetz also criticised Mr. Hildebrand's claim that the starting effort of the D-H locomotive will be double that of the Still locomotive. The Still locomotives are designed in such a way as to provide sufficient starting effort; in the two-cycle engine designed by the Schneider Company, Creusot, France, provisions are made for steam starting in both ends of the cylinders. In the four-cycle design, where the total volume of the cylinders is comparatively larger, steam is admitted only to the steam ends, as this is sufficient for starting and a larger tractive force would simply cause the driving wheels to slip. The normal action of the Still locomotive is always Diesel and steam, the latter steam costing nothing, whereas in the D-H locomotive the normal action is with the Diesel engine only and any steam which has to be used must be generated in the boiler with a corresponding consumption of fuel.

It is also brought out in the discussion that with the present steels in use, the dimensions of the crank pins in a direct driven freight locomotive are such that the driving wheels must be larger than necessary for tractive purposes only. If calculations are made on the basis of maximum permissible piston thrust, the cylinder dimensions can not exceed for our present conditions 16 in. in view of the high ignition pressure in the Diesel cycle. This would call for at least four cylinders for a medium sized locomotive and possibly more than four cylinders for larger locomotives. Moreover, as the rapid change of pressures in the Diesel cycle, especially at high speeds, gives the effect of explosions, it is quite possible that the dimensions of the pins, bearings, axles, frames, etc., would have to be increased. If this should be impossible, the dimensions of the cylinders will have to be further reduced.

It was also stated that the two-cycle Diesel engine which Mr. Hildebrand proposes can not give over 60 to 65 lb. per sq. in. mean effective pressure, whereas for starting, a mean effective pressure of at least 200 lb. would be necessary for the smaller cylinders, and for running conditions on continuous grades a mean effective pressure of about 160 lb. would be required. It is evident that the addition of steam will have to be very substantial, ranging from 200 to 300 per cent of that obtained from the Diesel cycle. Fig. 7 gives the tractive force of the D-H locomotive up to a speed of about 30 m. p. h., showing that the tractive force is higher than that of a steam locomotive. It does not mention the fact that in the steam locomotive, any tractive force below the maximum can be easily obtained by shortening the cut-off and running the locomotive more economically. In a Diesel locomotive the opposite is the fact; namely, that the efficiency will drop with the decrease of the tractive force.

Boston & Maine buys ten eight wheel switchers

Develop a tractive force of 56,800 lb. at 60 per cent cut-off—Boiler pressure, 250 lb.

TEN eight-wheel switching locomotives, designed for a boiler pressure of 250 lb. and equipped with feedwater heaters, articulated main rods and snow melting devices, have been received from the Baldwin Locomotive Works and put in service by the Boston & Maine at various yards to further expedite freight service and to effect new economics in operation. These locomotives have released an equal number of less modern eight-wheel switchers of lighter tractive capacity for assignment to other yards, this reassignment, in the end, retiring several of the least modern and effective yard locomotives.

The assignments were made to get the utmost benefit out of the increased tractive force and the fuel saving devices on the engines. The Boston & Maine expects to realize economies both from the latest improvements with which these locomotives are equipped, and from the ability of each unit to do a greater amount of work in a given time.

These locomotives are designed for operation on grades

One of the Boston & Maine eight wheel switchers equipped with a limited cut-off, feedwater heater and articulated main rods

up to 1½ per cent, and curves as sharp as 19 deg. With a weight of 244,800 lb. on the drivers, the engines develop a starting tractive force of 56,800 lb., the ratio of adhesion thus being 4.3. Such a ratio permits the development of full tractive force without slipping, under rail conditions.

The boiler

These locomotives have straight top boilers with wide fireboxes. The working pressure is 250 lb. On eight of the locomotives, the brick arch is supported on four tubes; while on the remaining two, the arch is carried on two tubes and two Nicholson syphons. A Type A superheater is applied, and the tubes and flues are welded into the back tube sheet. Flexible staybolts are applied to the breaking zones.

The boiler accessories include a feedwater heater of the Coffin type, with the feed pump placed on the left side at the rear end of the locomotive. On the feed pump delivery line is a fitting for attaching 50 ft. of 2-in. fire hose, which is carried on each engine. The feedwater heater is located at the front of and flush with the outside shell of the smokebox.

Table of dimensions, weights and proportions of the Boston & Maine eight-wheel switchers

Railroad	Boston & Maine
Type of locomotive	0-8-0
Service	Switching
Cylinders, diameter and stroke	23 in. by 28 in.
Valve gear, type	Baker
Valves, piston type, size	12 in.
Maximum travel	8½ in.
Outside lap	⅛ in.
Exhaust clearance	2⅝ in.
Cut-off in full gear, per cent	60
Weights in working order:	
On drivers	244,800 lb.
Tender	176,200 lb.
Wheel bases:	
Driving	15 ft.
Rigid	15 ft.
Total engine	15 ft.
Total engine and tender	54 ft. 10½ in.
Wheels, diameter outside tires:	
Driving	51 in.
Journals, diameter and length:	
Driving, main	11½ in. by 12 in.
Driving, others	10 in. by 12 in.
Boiler:	
Type	Straight top
Steam pressure	250 lb.
Fuel, kind	Bituminous
Firebox, length and width	102⅛ in. by 66¼ in.
Height mud ring to crown sheet, back	73½ in.
Height mud ring to rcown sheet, front	75½ in.
Arch tubes, number	4
Tubes, number and diameter	36—5½ in.
Flues, number and diameter	226—2 in.
Length over tube sheets	15 ft.
Grate area	47 sq. ft.
Heating surfaces:	
Firebox	190 sq. ft.
Arch tubes	24 sq. ft.
Flues and tubes	2,538 sq. ft.
Total evaporative	2,752 sq. ft.
Superheating	608 sq. ft.
Comb. evaporating and superheating	2,360 sq. ft.
Special equipment:	
Brick arch	Yes
Superheater	Type A
Feedwater heater	Coffin
Tender:	
Style	Rectangular
Water capacity	10,000 gal.
Fuel capacity	13 tons
General data estimated:	
Rated tractive force, 60 per cent cut-off	56,800 lb.
Weight proportions:	
Weight on drivers ÷ total weight engine, per ct.	100
Weight on drivers ÷ tractive force	4.29
Total weight engine ÷ Comb. heat. surface	72.6
Boiler proportions:	
Tractive force ÷ comb. heat. surface	16.9
Tractive force × dia. drivers — comb. heat. sur.	862
Firebox heat. surface ÷ grate area	4.55
Firebox heat. surface, per cent of evap. heat. sur.	7.77
Superheat. surface, per cent of evap. heat. surface	22.1

The ash pan is of cast steel and is fitted with hot water piping for washing the ashes off the slide slopes.

These locomotives are designed for limited cut-off. The piston valves are 12 in. in diameter and have a maximum travel of 8½ in. and a lead of ⅛ in. The steam lap is 2⅝ in. and the exhaust lap is ⅛ in. The Baker valve gear is applied, and is controlled by a Ragonnet Type E locomotive reverse mechanism.

Special materials are largely used for the machinery parts wit ha view of insuring ample strength for severe service, with minimum weight. The piston heads and the piston valve bodies and followers are of electric cast steel. Chrome-vanadium alloy steel, quenched and tempered, is used for the piston rods. The crank pins are of chrome-vanadium normalized steel and are hollow bored. The main driving axle and the main and side rods are of carbon-vanadium normalized steel. The axle is hollow-bored.

A forked main rod provides direct connection to the rear wheel crank, transmitting a portion of the piston thrust directly to the rear wheel, thus relieving some of the strain on the main crank pins and main journals. Main and side rod bushings are of the floating type to decrease wear.

The steam turret is arranged to permit all valve operating handles to be placed on one control board in the cab. All of the dial gages are similarly localized on one board for ready reference.

Each of the locomotives is equipped with snow melting devices which are located below and in back of the front bumper beam. These devices consist of live steam nozzles on four cylindrical drums, one on either side of each rail.

Flanged tires are used on all the wheels of these locomotives. Flange oilers are applied to the front and rear drivers. The transverse distance between tire faces is ⅛ in. less on these wheels than on the main and intermediate pairs. The cylinders are oiled by a force feed lubricator, driven from the valve motion.

The tender is carried on rolled steel wheels, and has a Commonwealth cast steel frame. The tank has a straight top an dthe side walls of the fuel space curve inward, following the contour of the cab roof, in order to give the engineman the best possible view when backing up.

Details of dimensions, weights and proportions are given in the table.

Proposed high pressure boiler— A correction

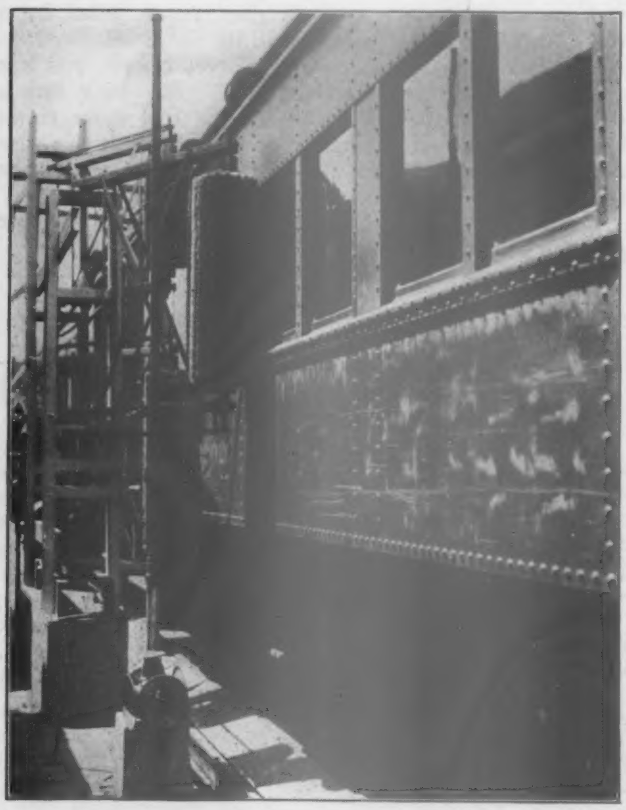
Two misstatements occurred in the article "Proposed high pressure water tube boiler," by Louis A. Rehfuss, which was published in the February, 1928, issue of the *Railway Mechanical Engineer*, page 68. On page 71, third paragraph, second column, the following statement "A 200-lb. pressure firetube boiler of about similar power would weigh around 105,000 lb. empty," etc., should read "A 200-lb. pressure firetube boiler of about similar overall dimensions would weigh around 105,000 lb. empty," etc. On page 73, the first column, fourth paragraph, a gain of three per cent in power as stated in the first sentence of that paragraph, should read 30 per cent.

Fay Automatic Lathe.—The Jones & Lamson Machine Company, Springfield, Vt., describes in an attractive 260-page book of twelve chapters the Fay automatic lathe, its construction, operation and adjustments, tools and attachments. Numerous photographs and line drawings show clearly the principal parts of the machine and the function which each performs. The book is intended to assist the tool engineer in designing tools and in estimating the production he will secure.

Passenger car washing machine

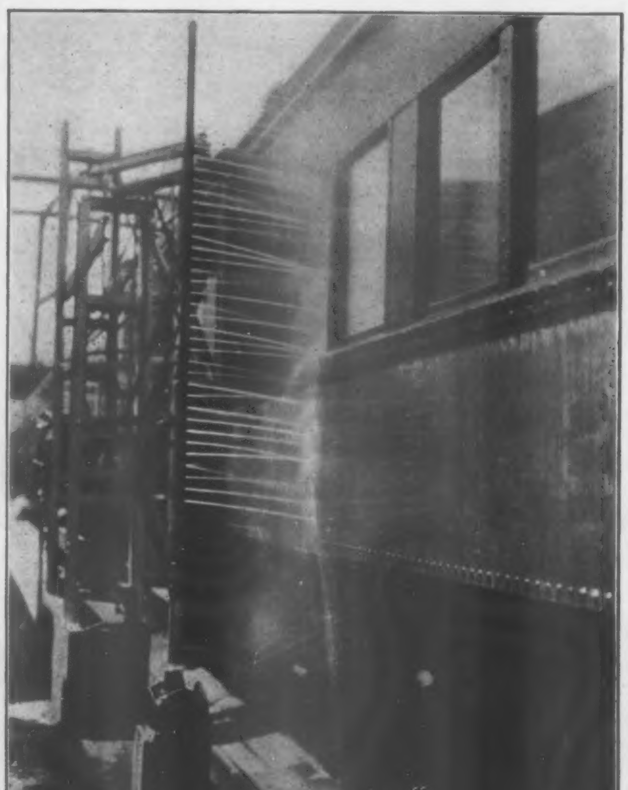
Baltimore & Ohio installs washing machine at its Tenth street coach yard at Pittsburgh

THE Baltimore & Ohio has had a passenger car washing machine in operation since last fall at its Tenth street coach yard, Pittsburgh, Pa., which is reported as rendering excellent service. This machine, which was built at its Glenwood shops,



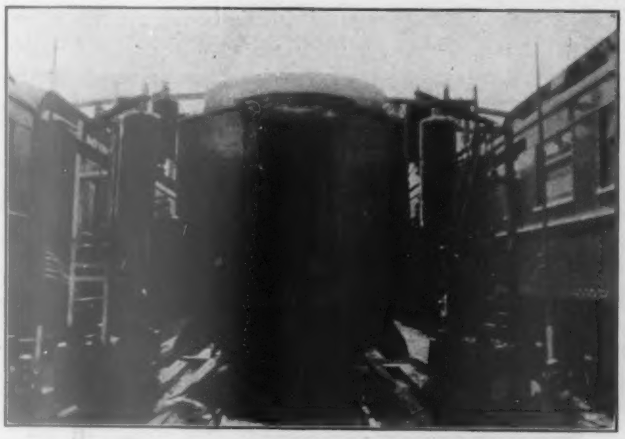
Showing the position of the revolving brushes relative to the side of the car

was originally designed for the washing and cleaning of street cars by the Pittsburgh Street Railways Company. The Baltimore & Ohio added certain features and changed some of the construction to adapt the machine to the cleaning of steam railroad equipment. It is understood that the patents on this machine are to be held jointly by the Baltimore & Ohio and the Pittsburgh Street Railways Company. A number of improvements have been made in the B. & O. machine since it was first installed. In addition to this machine, another steam railroad has constructed one of similar design which is now in service.



Car passing through the washing machine

The passenger car washing machine consists essentially of two frames built of rolled steel shapes, mounted on a concrete base, on which are mounted three revolving brushes with the necessary operating gears.

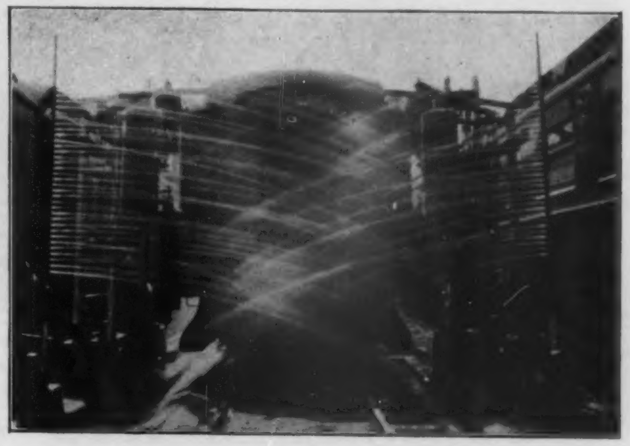


Passenger car about to enter the washing machine

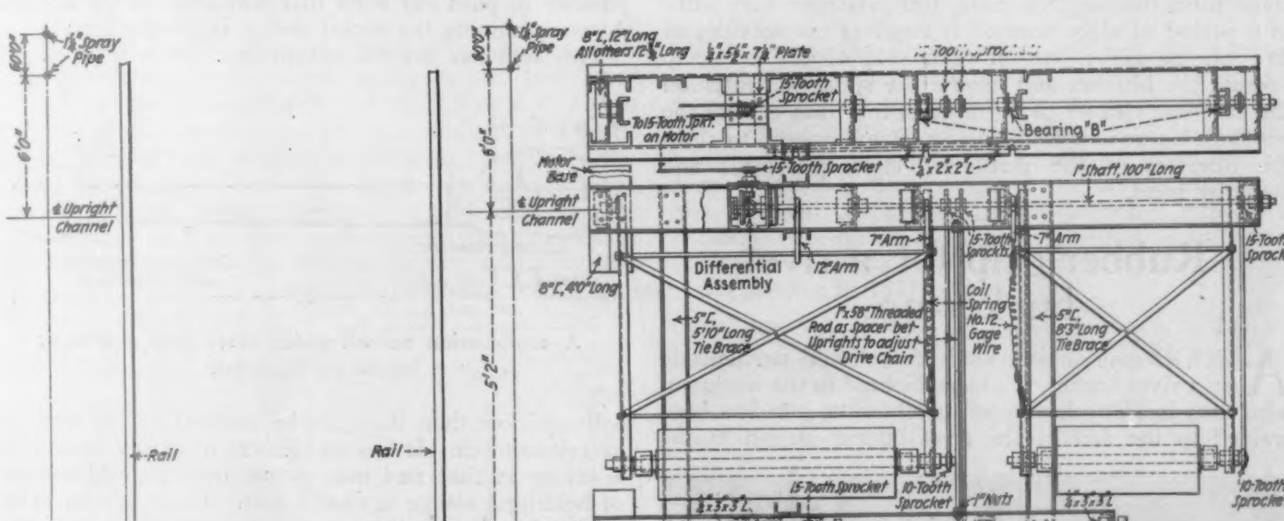
Referring to the general assembly drawing, the main frame upright supports are made of 8-in. channel sections. The bottom and top tie braces are made of 5-in. channels. The distance between the two frames on each side of the track is 15 ft. Each frame is provided with three swinging extension arms which support the revolving brushes. These brushes are rotated at 230 r.p.m. by a 5-hp. electric motor.

Sprocket drive is used from the motor to the vertical drive shaft and again from the shaft to the brushes. All vertical shafts have ball bearings, the detail assembly of which is shown in one of the drawings.

Each of the extension arms is provided with a coil spring made of No. 12 gage wire. As the cars are moved through the washing machine, the revolving brushes are held against the sides of the cars by the tension of this spring. This method of holding the brushes against the sides of the car is shown in the illustration of the car about to enter the washing machine. These tension springs permit the brush to



The sprays in operation

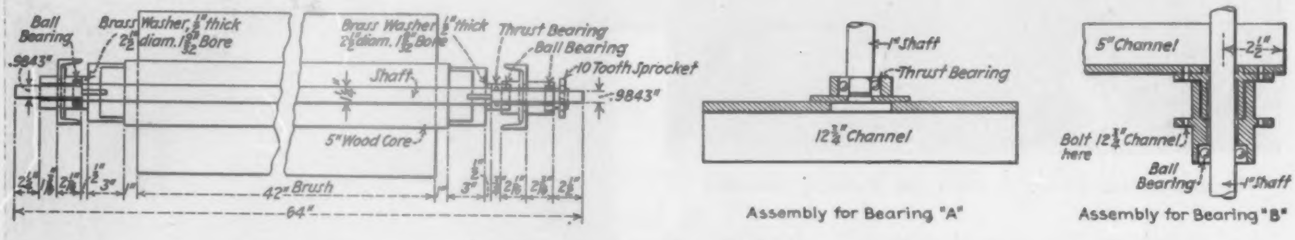


General arrangement of the car washing machine

adjust itself to any projections on the side of the car, the top brush cleaning the letter board, the center brush cleaning the windows and the lower brush cleaning the section below the belt rail.

A stand pipe, drilled with 3-32-in. holes, is located on the front and rear of each frame to throw a spray of water on the sides of the car. The first spray softens the dirt previous to the scrubbing action of the brushes and the last spray thoroughly rinses the car.

It requires from 2 to 2½ min. for a car to pass through this machine to get a thorough cleaning, which is a far superior method to the old one of cleaning by hand.



Detail of the bearing assemblies

It is possible to handle through this washing machine for a thorough cleaning, 100 passenger cars within a period of eight hours. It requires the services of five car cleaners; one on each side of the train, to operate the brushes and handle the spray of water on the car; one cleaner to go through the train closing the vestibule doors and windows, and two cleaners to clean the interiors of the vestibules, ends, platforms and steps by hand.

Rubber grip for a rivet bucker-up

A GOOD grip on any kind of tool, and particularly on a rivet bucker, is a beneficial aid to the workman who uses it. The handle of an old rivet gun has been welded to the end of the rivet bucker shown in the illustration. A short section of the air hose was split lengthwise and slipped over the grip and secured at each end by a piece of heavy wire. This simple arrangement, besides protecting the steel worker's hands from possible burns and bruises, provides a firm grip.

The rubber grip protects the workman's hands from bruises

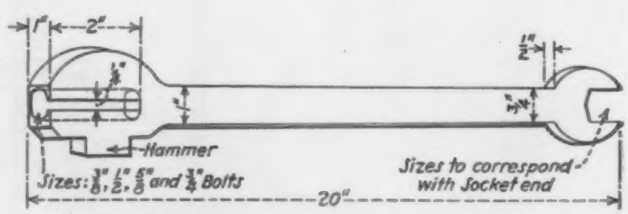
Combination wrench for the car repairman

By C. McMillan

Car repair foreman, Louisville & Nashville, Decatur, Ala.

THE illustration shows a combination wrench used by freight car repairmen for tightening and shearing small bolts. It can also be used for spreading draft key cotters and as a hammer. The wrench, which is 20 in. in length, can be made to handle ⅜-in., ½-in., ⅝-in. or ¾-in. bolts or nuts. The diameter of the hole in the socket end of the wrench is large enough to slip over the bolt for which it is intended. The depth of the socket is about 2 in. The ¼-in. slot in the side makes it possible to push out bolts that may stick in the socket. After machining the socket end, it is casehardened.

This tool has several advantages. It will break off bolts quicker than they can be snipped or cut with an acetylene torch. It has an element of safety as well as a saving in time and man power over the old method of holding a sledge against a bolt. There are no flying bolt ends. It usually requires two men with a sledge and chisel bar to spread a draft key cotter. With this tool, one man can do the work with more accuracy.

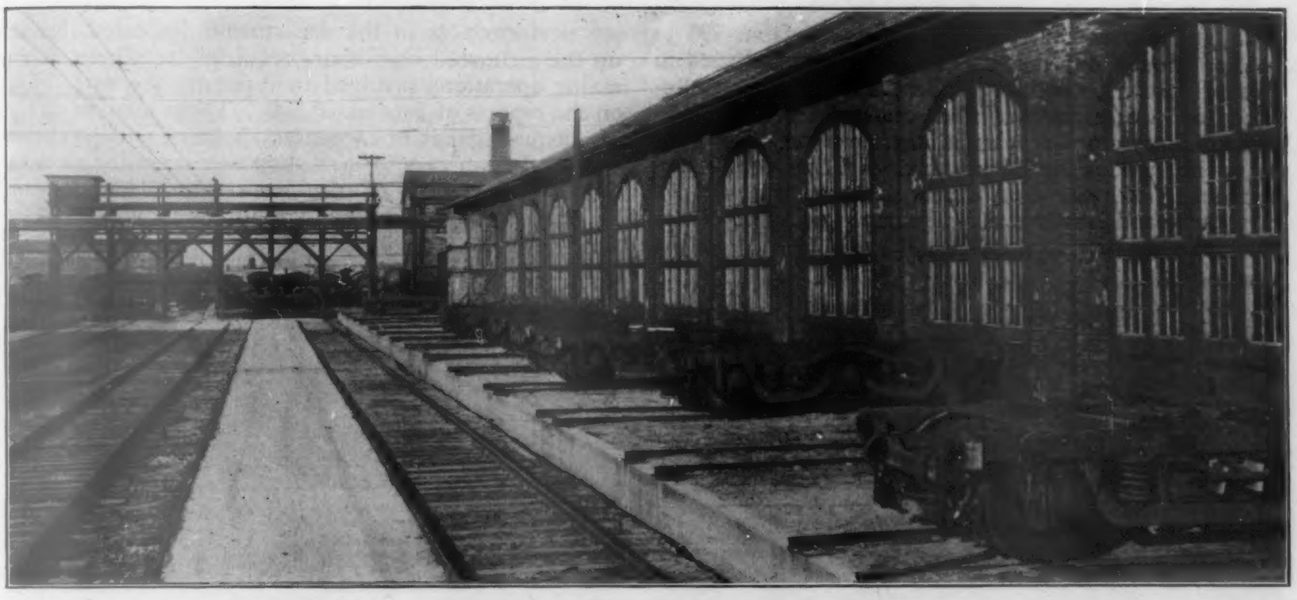


A combination wrench which saves time and labor for the car repairman

GRINDING AND POLISHING MACHINERY.—The Diamond Machine Company, Providence, R. I., gives in Bulletin No. 626 specifications for floor grinding and polishing machines. These machines are equipped with safety countershafts and belt shifters supplied by the Builders Iron Foundry.

WOODWORKING MACHINERY.—Catalogue No. 24 issued by the Oliver Machinery Company, Grand Rapids, Mich., describes the Oliver Junior Line of woodworking machinery. Band saw brazers, oilstone tool grinders, wood trimmers, vises, clamps, etc., are featured in this line of portable woodworking machinery.

GROUND THREAD HANDBOOK.—Considerable data on tapping, gaging of threads and measurement of holes, is given in the new Ground Thread Handbook, Catalogue No. 11, issued by John Bath & Co., Inc., 8 Grafton street, Worcester, Mass. Tapes, chasers, thread gages and rolling dies are illustrated in this catalogue.



Outside the C. & N. W. coach repair shop—View shows runway for truck transfer table and generally picked-up condition

Passenger shop work organized

Measuring stick of performance set up by effective man-hour schedule at C. & N. W. shops

WHILE not yet fully developed, a plan has been initiated and installed during the past four years in the Chicago shops of the Chicago & North Western for organizing car repair operations on a much more efficient basis than formerly, both as regards material handling and labor operations. In the passenger car department, to the operation of which this article is confined, cars are now ordered into the shops with much greater consideration to balancing total daily output as well as the output of sub-departments; material requirements are studied and to a large extent provided for in advance; repair operations are scheduled in an orderly way and on a man-hour basis, by means of which performance marks are set up for individuals and departments and a reasonably accurate comparison obtained of actual and desired output.

It is practically impossible to measure the increase in output per man employed or the decrease in unit costs which have unquestionably taken place, because only recently have schedule man-hour records provided a fairly definite knowledge of the amount of work being done. Past records of output based on the number of cars repaired per month are available but difficult to evaluate, because of the highly indefinite character of the car repair classificaton which, for example, may mean 750 man-hours for a general repair in one case and 1,200 man-hours in another. Some idea of the improvement effected, however, may be obtained from the table of output which indicates that in 1927, as compared with 1924 when the schedule was first being installed, 245 more cars were handled by shop forces, a substantial proportion of them being heavy repair steel cars,

Performance sheet for last two months in 1927

Shop	No. of working days	No. of cars thru shop: Gen. rep. Wood	Gen. rep. Steel	Lt. rep. Wood	Lt. rep. Steel	No. of men	Net output in man-hrs.	Av. sched. output in man-hrs. per man	Actual hours consumed	Loss in man-hrs. per man	Efficiency of shops
November, 1927											
Paint	20	19	46	0	0	50	5868	117	8296	9	93.2
C-3	20	4	26	2	33	59	7145	121	8160	17	87.6
C-5	20	16	14	1	1	45	6069	134	6795	16	88.3
Trim.	20	19	46	0	0	37	4720	137	5083	10	92.9
Uphol.	20	11	38	0	0	27	3242	120	3468	2	98.9
Plat.	20	10	40	5	5	46	6258	136			
Truck	20	20	44	7	9	50	9474	189			
Pipe	20	17	45	1	1	37	5038	136			
Tin	20	19	43	0	1	45	4636	103			
		144	242	16	50	396	52,450				
December, 1927											
Paint	21	26	32	3	0	50	5437	108	5953	10	91.3
C-3	21	3	22	13	8	56	7934	141	8401	6	94.2
C-5	21	26	2	11	2	46	6087	132	6539	10	93.0
Trim.	21	22	20	3	2	37	4875	132	5260	10	92.7
Uphol.	21	21	25	4	2	27	3480	120	4141	4	97.7
Plat.	21	30	28	18	7	46	5607	121	7152		
Truck	21	27	26	23	3	50	9649	183	11499		
Pipe	21	32	34	13	5	38	4891	128	7432		
Tin	21	27	28	6	3	45	4663	103	5920		
		214	217	94	32	395	52,623				

and yet the man-hours per car decreased from 995 to 941, or about 5.4 per cent. This was accomplished in spite of the substantially higher standard of maintenance now in effect and other unusual work, such as extraordinary truck repairs, a larger proportion of steel car work, application of new axle lighting equipment, remodeling of chair cars, diners, baggage cars, lounge cars, etc., sand blasting and a general raising of equipment painting standards.

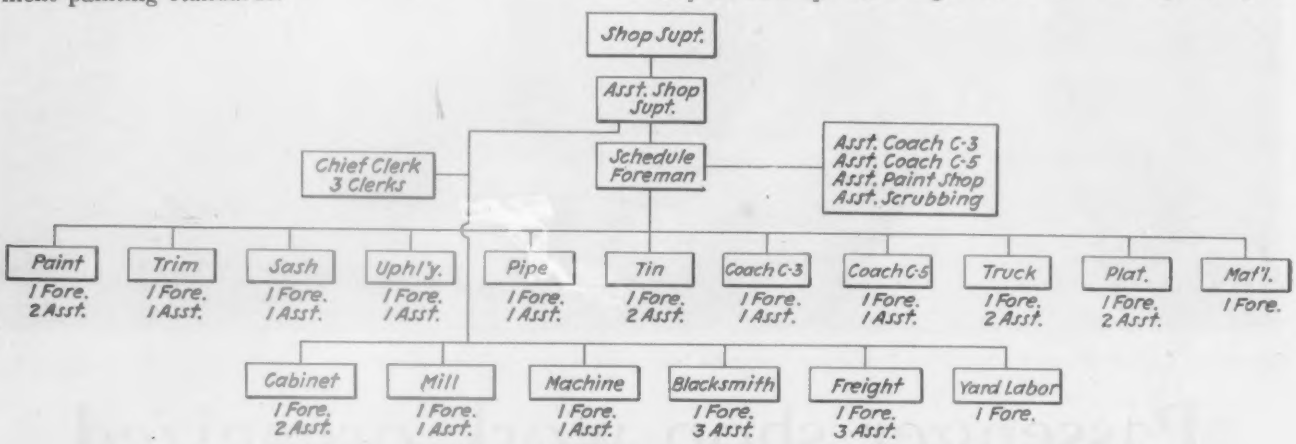


Chart 1—Showing supervisory and schedule organization at C. & N. W. Chicago shops

The most important part of any car, or locomotive repair shop for that matter, is the supervisory organization which, if ineffective for any cause, will largely discount the efforts of the most efficient shop force or the effect of the best shop layout and the most modern machine equipment. On the Chicago & North Western, the locomotive and car departments are entirely independent, all car matters coming under the jurisdiction of the superintendent of the car department through an assistant. The car shop organization from the shop superintendent down is indicated in Chart I which shows an organization designed, with suitable forces in the 17 sub-departments, to turn out about four heavy repair cars and two light repair cars a day.

Outside the upholstery shop—View showing operation of blowing dust out of cushions—Shop refuse wagons at right

Passenger shop organization

The important function of the schedule foreman with direct supervision over 11 sub-departments is at once apparent. Besides assigning schedule dates and checking performances in the departments indicated, he sets up the estimated man-hours required for all detail and major operations involved in repairing the cars, based on the reports of four assistants. These men, in charge of adequate gangs of carpenters, helpers, and scrubbers, strip and clean cars to the extent necessary for an accurate determination of the work needed before any schedule is made out, thus largely obviating the necessity of subsequent changes of dates. It may safely be said that the development of this schedule force with sufficient knowledge, experience and authority to be a real factor in operating the shop is the primary reason for its success. It works with and helps the other foremen, thereby receiving their hearty support.

The mechanical features of the schedule, including the entering of all important dates on a master schedule board in the office, the sub-division of these dates on departmental schedule boards, and on smaller boards located at one end of each track in the coach and paint shops, do not differ essentially from those previously described on several occasions in the *Railway Mechanical Engineer*. The forms used are much the same and will not be reproduced in this article in detail. Suffice it to say that material delays are watched with a keen eye and to a large extent anticipated a sufficient length of time in advance to prevent holding cars beyond their schedule dates of completion. All failures to meet

schedule dates are reported daily on a form giving the time when the work will be completed and the reason for the delay. This enables conditions causing difficulties to be studied and to a large extent eliminated. It will be noted that the cabinet shop, mill room, machine shop, blacksmith shop, freight shop and yard labor force

Truck material, both wood and steel, neatly piled and housed at the north end of truck shop

do not report to the schedule foreman. Most of the operations in these shops are already on a production basis. The small amount of individual car work is scheduled by the foreman to meet over all dates already set by the schedule foreman.

The feature of the North Western shop schedule, which makes it distinctive and unlike almost any other now in use, as far as the *Railway Mechanical Engineer* knows, is that the operation of stripping, trimming, carpenter work and painting are scheduled in detail on a man-hour basis and subsequently checked with the pay roll man-hours of these operations, an accurate basis for determining the efficiency of the four departments mentioned thereby being obtained.

The time allowed for each operation has been established as a result of time studies and the practical experience of men assigned to the schedule department, the main objective being to set the performance mark within the possible reach of the average mechanic and thus stimulate a friendly, competitive spirit and increased interest in the work. As mentioned, in the mill room, blacksmith shop and wheel shop, standards are set up for production performance which are checked monthly.

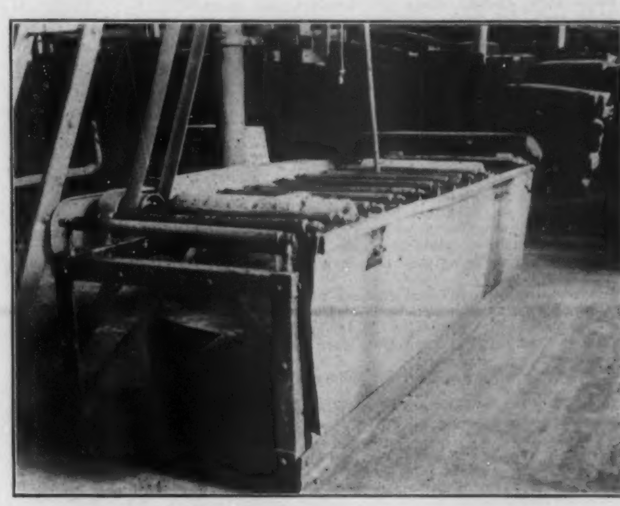
Output of passenger car shops

	1924	1927
General repairs, steel	404	531
General repairs, wood	548	408
Light repairs, steel	110	259
Light repairs, wood	123	232
Total cars repaired	1,185	1,430
Pay roll man-hours	1,179,525	1,345,337
Average man-hours per car	995	941

Typical schedule operations in the coach shop, upholstering department and paint shop, together with the time allowed for each, are shown in one of the tables.

Daily performance records for each of these departments are turned in to the shop superintendent's office containing complete information regarding the time the work is received, time completed and man-hours consumed, from which a monthly performance sheet is filled out. This forms a basis for determining the relative efficiency of the various departments.

Referring to this table for the month of November, which involved 20 working days, it will be noticed that the output of heavy and light repair cars, as well as the schedule and pay roll man-hours for each department are indicated. In obtaining the net output each department is credited with the number of man-hours of uncompleted work on cars in the shop the first day of the month and debited with the number of man-hours of uncompleted work on the last day of the month. It is therefore possible to compare the schedule



Double power brush machine for washing cushions

and actual man-hours, determining the loss in man-hours per man.

For example, in the month of November, the upholstery department made the best showing and obtained an efficiency of 98.9 per cent, the coach shop

C-5 being the lowest with an efficiency of 88.3 per cent. It is recognized that conditions over which foremen have no control may offer a satisfactory explanation for unfavorable showings, but it will be obvious that the establishment of efficiency ratings and resultant explanations of the reasons why certain marks cannot be

Cushion rack truck being pushed into dry room

reached will focus attention on these conditions and permit their being remedied. With proper interpretation and the proper spirit, the establishment of these results will stimulate competition and interest on the part of foreman and men.

The figures for December, which was a 21-day month, show a substantial increase in efficiency over November.

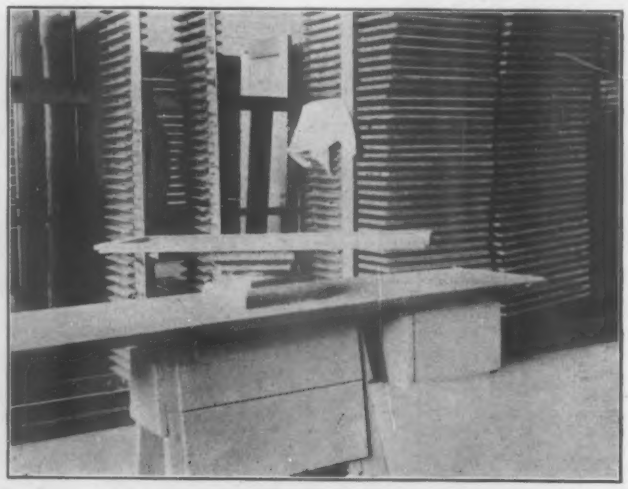
Typical schedule operations

Stripping	
Body sash, curtain stops and headers, per window	5 min.
Body sash, top sash, parting strips, stops, per window	6 min.
Deck sash and transoms, per car	38 min.
Trimming	
Non-vestibule coach, complete	18 hr. 23 min.
Steel vestibule coach	34 hr.
Apply brackets, each	9 min.
Apply sofas, each	8 min.
Apply cushions and backs, each	4 min.
Apply body sash curtains, each	3 min.
Upholstering	
Cushion complete, including spring	6 hr. 10 min.
Cushion back complete in muslin	4 hr. 40 min.
Applying plush or leather bands, each	10 min.
Sewing window curtains, each	24 min.
Parlor car chair complete in plush	19 hr.
Parlor car chair complete in leather	20 hr.
Carpenter work	
Window sills removed and applied, per lineal foot	23 min.
Window corner stops renewed, each	23 min.
Remove and rehang mail car slide doors	3 hr. 36 min.
Remove and apply diaphragm face plates and canvas complete	8 hr.
Replace steel with wood crown molding, 60 ft. car	68 hr.
Painting	
Varnishing steel coach, complete exterior	6 hr.
Painting roof and deck	4 hr.
Blacking off	2 hr.
Painting trucks and platforms	4 hr.
Varnish below head lining, interior	5 hr.
Painting seat castings and pipes	3 hr.

In that month the upholstery shop again made the best showing with the paint shop the lowest. In the latter case, however, the pay roll man-hours exceeded the schedule set by only 10 hours per man per month. In all, 431 cars were given general repairs and 126 light repairs by a force of 395 men in the departments shown.

The monthly performance sheets also carry information regarding car days of delay and the departments responsible; also the number of pay roll man-hours unaccounted for on the work slips, thus affording a measure of the accuracy with which the departmental foremen are checking the details of their work.

To give an idea of the extent of conditioning oper-



Sash painting also expedited by table with swiveling stand at convenient height

ations performed on general repair cars, a completed record of passenger car No. 1013 is shown, which indicates that a total of 1,032 man-hours were consumed in the work. This was a wooden baggage car handled in accordance with the usual practice.

Scheduling and balancing the work

One of the most important advantages of the schedule system as employed at the Chicago & North Western shops is the opportunity afforded to balance operations in the various shop departments. The way in which this is brought about can best be described by outlining the methods followed in taking the average car into the shop and scheduling its various operations. With the detailed knowledge of how long passenger cars have been in service, it is comparatively easy to determine the prospective dates when repainting will be necessary, or sand blasting in the case of steel cars, and burn-off in the case of wooden cars. Cars are ordered to the shop

Table with swiveling top which saves labor in painting chairs, particularly heavy ones

largely on the basis of their paint condition in connection with their general physical condition. On being received they are held until available space permits their being transferred into the shop where the preparatory work of stripping and scrubbing is performed by the schedule force, all visible defective parts being removed

Typical schedule board located at each track in the coach and paint shops

to afford an opportunity for noting the amount of repairs needed and ordering the necessary material. It is at this time that the number of man-hours required for the carpenter work is set up by the schedule foreman, thus enabling the schedule date to be set for completion of the carpenter shop work. If it develops that the repairs on the car will be too heavy or will throw too much work into one department, another car is substituted, the first being worked on as opportunity offers until such time as it can advantageously be placed in the regular schedule.

Having determined the length of time the car will remain in the coach shop, it is easy to establish the man-hours in the paint shop and set up the outgoing date, together with all intermediate dates, on the master schedule board. It is obvious that if the order established by the schedule of cars in the carpenter shop were followed strictly, the result would be to bunch the work in the paint shop which is undesirable. This is taken care of by so arranging the paint shop schedule that a uniform daily output of about four cars a day is obtained.

Material is handled about the shops by a material foreman and gang of 18 helpers equipped with two power-driven trucks, two tractors and about 75 trailers. This material foreman arranges to have trailers ready for material being stripped out of cars, being advised by foremen as to their respective needs. The trailers are then delivered to the proper shops. In addition, the material handling gang serves all of the various shops including the blacksmith shop, machine shop, mill room, cabinet shop, etc., for the inter-handling of materials. The material foreman has a schedule board on which are posted the dates for material delivery and trailers containing the various car materials are delivered in accordance with this schedule. As mentioned in a previous article in the *Railway Mechanical Engineer,* all passenger car truck transfers are made by the material foreman and his gang, using a small transfer table moved by one of the tractors.

Shops and grounds unusually clean

One of the noticeable features at the passenger car shops is the order and cleanliness generally apparent and shown in several of the illustrations. The responsibility for this condition is divided between the various foremen to each of whom a specified territory is assigned. Fifty-three laborers are employed in the work of gathering and removing scrap wood and refuse from the shops and adjoining territory to a space centrally located and arranged for the burning of this material. A certain number of the laborers work as a floating gang for the purpose of taking care of the burning site and cleaning the adjoining territory, raking up around the shops and grounds and picking up scrap bolts, nuts, washers, etc.

Scrap, refuse and usable material trailers are provided as needed at each shop, thus preventing the unnecessary rehandling of usable and reclaimed material and reducing the manual labor involved in keeping the shops clear of dirt and refuse. These trailers are picked up daily by the material gang and delivered to the proper destination.

The general shop cleanliness is checked by means of a monthly inspection by three foremen constituting a committee. This committee reports the result of its inspec-

Chicago & North Western passenger car repair record for car No. 1013

Operations and order in which performed	Shop No.	Track No.	Schedule date of completion	Work Completed Date	Work Completed Time	Man-hours consumed
Car in shop	1	13	8/25	8/25	10:55	1
Car stripped			8/25	8/25	3:30	3
Sash, doors, furniture delivered to shops						
Upholstery delivered to shops			8/30	8/30	3:00	1
Sand blast or burn off						
Burn off sash and doors						
Car scrubbed			8/26	8/26	11:55	46
Varnish removing						
Stripping defective parts			8/30	8/30	8:25	33
Car removed to carpenter shop	5	8	8/29	8/29	2:45	2
Trucks removed			8/29	8/29	10:30	3
Trucks repaired			8/29	9/8	11:30	124
Platform work			10/22	10/22	11:55	212
Cabinet shop work			8/31	8/31		24
Carpt. shop—exterior			10/23	10/23	11:55	324
Carpt. shop—interior						
Carpt. shop work — sash room			10/21	10/21	9:00	11
Roof work—tin shop			10/22	10/22	9:25	33
Roof work—upholstery shop						
Pipe work			10/29	10/29	10:00	54
Tin shop work—interior			10/29	10/29	11:25	6
Monolith floor work						
Lamps, buffing and baskets			10/5	10/5	9:00	2
Trucks under car			10/22	10/22	8:30	1
Car removed to paint shop	2	4	10/24	10/24	9:55	2
Carpets cut and fit						
Paint roofs and decks			10/28	10/28	2:00	4
Paint exterior and letter			10/29	10/29	10:00	39
Paint interior and vestibules			10/28	10/28	4:00	14
Paint floors			10/28	10/28	1:00	2
Paint trucks and black off			10/28	10/28	4:00	6
Paint doors, sash, stops, etc.			10/26	10/26	9:15	3
Paint furniture, chairs, etc.						
Clean glass—paint shop			10/29	10/29	11:00	4
Clean glass—sash room						
Apply rubber or linoleum						
Upholstery work						
Plumbing						
Test heaters, pipes, valves, etc.						
Trim roofs, etc.			10/29	10/29	10:25	5
Level up and adjust brakes			10/29	10/29	10:00	40
Wiring						
Test electrical work						
Deliver sash, doors, furn., etc. to car			10/28	10/28	10:00	1
Deliver upholstery to car						
Apply platform and step rubber						
Trim car			10/31	10/31	1:30	16
Touch up on shipping track			10/31	10/31	2:00	4
Clean floors, etc.						
Miscellaneous						
Car released for service			11/2	11/2	11:55	3
Total man hours						1023

	1924	1927
General repairs, steel	404	531
General repairs, wood	548	408
Light repairs, steel	110	259
Light repairs, wood	123	232
Total cars repaired	1,185	1,430
Pay roll man-hours	1,179,532	1,345,337
Average man-hours per car	995	941

tion or findings on a form provided for this purpose and rates each department in accordance with the following considerations:

Unclean or untidy premises	25 per cent off
Fire hazard	25 per cent off
Obsolete material on hand	20 per cent off
Material lying around, scrap	15 per cent off
Material lying around, usable	10 per cent off
Surplus stock	5 per cent off

To promote a more ready understanding of the bulletins as issued and posted in the shops, those departments having 100 per cent are designated Class I; 95 per cent, Class II; 90 per cent, Class III; per cent, Class IV, etc. That this method has been effective is shown by the fact that in the period intervening between the issuance of Bulletin 1 and Bulletin 10, the number of departments rated in Class I increased from 2 to 15, with only one department in the latter bulletin being shown in Class VI.

Foremen are also required to make weekly inspections of the shops and ground and in addition, to inspect all cupboards, lockers, drawers, etc., once every 10 days.

Method of handling cushions

Considerable interest attaches to the method of handling cushions. On being stripped and removed from the car by the stripping gang, these cushions are loaded on trailers and delivered to the upholstery shop. Here they are blown out with air as illustrated, then being transferred to the washroom and washed with soap and water by a machine having two power-driven brushes. When dyeing is necessary, this operation is performed and the cushions are then loaded on truck racks and placed in a dry room heated with air drawn through steam pipes by an electric-driven fan.

The capacity of this dry room is six cars. An important feature is the vertically sliding door which is air-operated and provided with a safety lock, as shown in the illustration, to prevent the door from falling in case the cable breaks or air pressure is lost.

After two hours in the dry room, the cushions go to the upholstery room for necessary repairs, the cushions being loaded on trailers ready for delivery to the car.

Almost innumerable labor saving devices have been developed and applied in the North Western shops, two simple methods of saving time and labor in the paint shop being indicated. In painting chairs, for example, the table shown with a revolving top at convenient height has proved effective especially for heavy chairs or other portable furniture. The chairs are painted complete in one handling from one position. A similar table for sash painting is illustrated.

Monthly foremen's meetings helpful

One feature of importance tending to promote better cooperation and improved morale among the supervisors is the meeting of all shop foremen held at the Chicago & North Western Y. M. C. A. building, one evening each month. At these meetings subjects of general interest and inspiration are generally presented by one speaker each evening, an effort being made in this part of the program to keep away from the details of regular shop practice. For example, subjects presented at recent meetings were "Relation of the car department to the operating department," "High cost of poor work," "Brake maintenance and adjustment," "Necessity for accounting," etc.

The balance of each meeting is usually devoted to suggestions for improvement, and these are welcomed from the least experienced assistant foreman as well as from the oldest and most experienced, no limitation being placed on the discussion. An evidence of the practical value of the suggestions made in the past year is that out of a total of 48 submitted, 44 have been adopted and made standard practice. The interest of the members is shown by the attendance, 44 out of a total of 46 foremen and assistant foremen being present at the last meeting.

Decisions of the Arbitration Committee

(The Arbitration Committee of the A.R.A. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)

Repairs claimed to be excessive and unwarranted

On October 26 and November 23, 1925 the Seaboard Air Line received from the St. Louis-San Francisco two car repair bills. The Seaboard took exception to the charges made on 23 of the cars covered in the two bills and held up payment as the exceptions taken amounted to more than 50 per cent of the bills as rendered, according to A. R. A. Rule 91. The Seaboard contended that the cars were not repaired in accordance with A. R. A. rules and that the Frisco removed serviceable material from each car. The Frisco contended that the repairs were made to the cars on account of owner's defects and properly chargeable to the owner.

The Arbitration Committee stated that "It is not the intent of Rule No. 1 that excessive or unwarranted repairs should be made to foreign cars, however, the evidence in this case is not conclusive that the St. Louis-San Francisco made excessive or unwarranted repairs to the cars in question. Therefore, the contention of the Seaboard Air Line is not sustained."—*Case No. 1533—Seaboard Air Line vs. St. Louis-San Francisco.*

Repairing line not held responsible for applying wrong coupler

On December 11, 1925, the Nashville, Chattanooga & St. Louis repaired NTCX tank car No. 2314, applying a new Sharon 5-in. by 8½-in. butt coupler and removing the same make and size of coupler on account of a broken head, parts worn out and the coupler pocket broken at the B end of the car. When the North American Car Company received the car on December 22, 1925, a joint evidence card was produced showing one 5-in. by 5-in. by 9⅛-in. butt coupler at the Be end of the car, a 5-in. by 7-in. by 8½-in. butt, being standard to the car. One coupler pocket 1¼ in. by 5 in. by 18½ in. should have been 1¼ in. by 5 in. by 15½ in. This joint evidence card, together with the North American Car Company's repair card was forwarded to the N.C & St. L. on February 20, 1926, requesting that defect card be furnished for these wrong repairs. On February 24, 1926, the N. C. & St. L., wrote the National Tank Car Company, the owner of the car, refusing to furnish the defect card for the wrong coupler and yoke, claiming that the car was stenciled at the B end for a 5-in. by 5-in. coupler.

The decision of the committee reads: "In view of the

original record of repairs showing the car stenciled for a 5-in. by 5-in. shank coupler, B end, and inasmuch as the joint evidence does not specifically indicate how the car was stenciled, the Nashville, Chattanooga & St. Louis is not responsible for the wrong coupler. The record of stenciling found on the car eight months later (after repairs were standardized) has no bearing on this point.

"The Nashville, Chattanooga & St. Louis is, however, responsible for the coupler yoke, incorrect length, as per joint evidence."—*Case No. 1534—National Tank Car Company vs. Nashville, Chattanooga & St. Louis.*

The triple valve rebushed but improperly threaded

On May 28, 1926, the Houston & Texas Central made repairs to the air brake equipment on Texas & Pacific car No. 3745. On July 2, 1926, the T. & P. secured a joint evidence card which read as follows:

WH K-1 triple exhaust port drilled out to one-half inch and improperly threaded; leaking air around exhaust port plug. Last cleaned by the H. & T. C. Ry. 5-28-26 at Ennis.

The T. & P. requested a defect card for the scrap triple valve body which request was declined by the H. & T. C. The owner contended that the H. & T. C. had rebushed the exhaust port and drilled it too large. This statement the H. & T. C. denied, claiming that it had only cleaned and tested the triple valve and replaced it on the car.

In rendering its decision the Arbitration Committee stated that "It is good practice to bush the exhaust ports in triple valves within proper limits. However, the joint evidence shows the exhaust port was improperly threaded, resulting in leakage at this point. Accordingly, the Southern Pacific Lines is responsible for this condition. Note—The question of limitations for rebushing has been referred to the Committee on Brakes and Brake Equipment."—*Case No. 1535—Texas & Pacific vs. Southern Pacific, Texas & Louisiana.*

Rule 32 again protects handling line

On December 24, 1925, a Cleveland, Cincinnati Chicago, & St. Louis train consisting of 24 loads and 59 empties backed out of a siding onto the main line to take water. During this operation, St. Louis-San Francisco car No. 32867 and three other cars were damaged. When the owner received a bill for the repairs made to the car, it declined the bill on the basis that repairs had been made to seven sills for which no explanation accompanied the repair card as required by Rule 44. The handling line then furnished a statement from the conductor of the train which explained how the accident occurred. This statement was not satisfactory to the owner and was returned to the handling line for additional information. The owner contended that the car had been damaged under the conditions set forth in Rule 32 which the handling line denied.

The Arbitration Committee stated "That the car had not been subjected to any of the unfair conditions of Rule 32. The car owner is responsible."—*Case No. 1536—S. Louis-San Francisco vs. Cleveland, Cincinnati, Chicago & St. Louis.*

Defect card marked "Labor only" issued for making wrong repairs is sustained

On February 8, 1924, the Chicago, Milwaukee & St. Paul rendered a bill to the Chicago & Eastern Illinois for repairs made to Mather car No. 54020. When the repairs were made, the St. Paul applied one wood truck bolster in place of a cast steel truck bolster on account of being broken (owner's responsibility). The St. Paul applied a defect card to the car which was marked "labor only." The owner rendered a bill to the St. Paul in which was included a charge covering labor and material in connection with the correction of the wrong repairs on authority of the St. Paul's defect card. The St. Paul contended that the owner should have confined its charge on authority of the defect card to labor only, in accordance with Rule 88. The owner did not agree with this contention.

The position of the Chicago, Milwaukee & St. Paul was sustained by the Arbitration Committee.—*Case No. 1537—Chicago, Milwaukee & St. Paul vs. Mather Stock Car Company.*

Handling line held responsible for car destroyed by fire

On June 22, 1926, St. Louis-San Francisco car No. 1203, together with six other empty cars, was placed on a designated interchange track by the Kansas, Oklahoma & Gulf for delivery to the St. Louis-San Francisco. On June 23, the car was destroyed by fire. None of the other cars were damaged as they were pulled away from the car by a Frisco yard crew, who also used fire extinguishers on the car in question, but without success. The Frisco contended that, inasmuch as the car had not been inspected and accepted by its inspector, interchange had not been signed nor any other action taken toward receiving the car, it was still in the possession of the K., O. & G. and that settlement should be made on the basis of its depreciated value. The K., O. & G. contended that under Car Service Rule No. 6, the car was in possession of the Frisco at the time of its destruction.

The St. Louis-San Francisco was held responsible, as the car was in its possession at the time the damage occurred.—*Case No. 1538—St. Louis-San Francisco vs. Kansas, Oklahoma & Gulf.*

A car should not be reloaded after carded for the repair shop

On or about July 15, 1926, Green Bay & Western car No. 4631 was carded by the Grand Trunk Western to be returned to the delivering line when empty on account of defective metal center sills. Instead of being returned to the delivering line, it was loaded with gravel on the Grand Trunk and in handling, on August 6, the coupler and end sill pulled out at the A end. The Grand Trunk Western contended that the failure did not occur until 21 days after the defect cards had been applied and that the car had passed through two inspection points and one repair point without shopping, and stated further that none of the conditions of Rule 32 were violated and that all of the requirements of Rule 120 were complied with. The owner contended that the handling line should not have reloaded the car after it had ordered the car returned to the delivering line.

The Arbitration Committee stated that "The handling line had not furnished sufficient information to substantiate its contention that the combination of damage to this car occurred in fair usage. The handling line is responsible."—*Case No. 1539—Grand Trunk Western vs. Green Bay & Western.*

An iceless refrigerator car

Equipped with silica gel refrigerating apparatus—Thermostat control insures uniform temperature for variety of service

THE Safety Car Heating & Lighting Company, New York, has had in service for a number of months an iceless refrigerator car, the principle of the operation of which is based on certain physical properties of a substance known as silica gel. No source of mechanical power is required, the operation being effected by heat from a stored gas supply.

Several long haul runs have been made with the first car equipped with this system and the results have been uniformly successful. A variety of commodities have been carried, including frozen fish, oranges, and cantaloup. A test run was made last December from New London, Conn., to Fort Worth, Tex., with 19,865 lb. of frozen haddock fillet packed in cartons and wooden boxes, making a gross weight of 24,664 lb. Temperature observations were taken throughout the run by means of several thermo-couples placed at various points in the car, the averages of which are shown in one of the illustrations. At no time did the temperature at any point in the car exceed a temperature at which the thermostat was set. The car was precooled to two degrees above zero before loading and the temperature of the fillet when loaded averaged 18 deg. F. The fillet was unloaded at a temperature of 14 deg., having been in the car 11 days. It was not necessary to refuel during the run and only half of the initial charge was consumed.

Silica gel—Its composition and properties

Silica gel is a hard, glassy material with the appearance of a clear quartz sand, of the chemical formula SiO_2 and is chemically inert toward practically all substances. During the manufacture of silica gel, the steps of the process are carefully controlled so that the physical structure of the finished silica gel is of an extremely porous character. The pores are so minute they cannot be detected under a microscope, but a study of its action indicates that it must possess such a structure. It has been determined that the voids constitute 41 per cent of its volume.

The presence of these minute voids gives silica gel the ability to adsorb relatively large quantities of vapors. As an example, a quantity of silica gel placed above water in a closed vessel will adsorb, or take up, water vapor to the extent of 25 per cent of its own weight. If it is then removed from the vessel and activated by heating, the water vapor will be driven out and the silica gel rendered capable of adsorbing more vapor. This action is purely physical, and the cycle may be repeated indefinitely, with no alteration in the structure of the silica gel, or decrease in its adsorptive power. It is this peculiar property of silica gel which forms the basis of the operation of this iceless refrigerator car.

Operation of the refrigerating apparatus

The apparatus consists essentially of three main parts; namely, the adsorber (containing the silica gel), evaporator and condenser. It may be briefly described as being identical to a compression type machine with

Experimental iceless refrigerator car which is being tested in actual service by the Safety Car Heating & Lighting Co.

a compressor replaced by the adsorber; the adsorption of the refrigerant vapor by the silica gel corresponding to the suction stroke of the compressor and the activation of the silica gel to the discharge stroke. No power need be generated for the silica gel system, the necessary heat being applied directly to the silica gel.

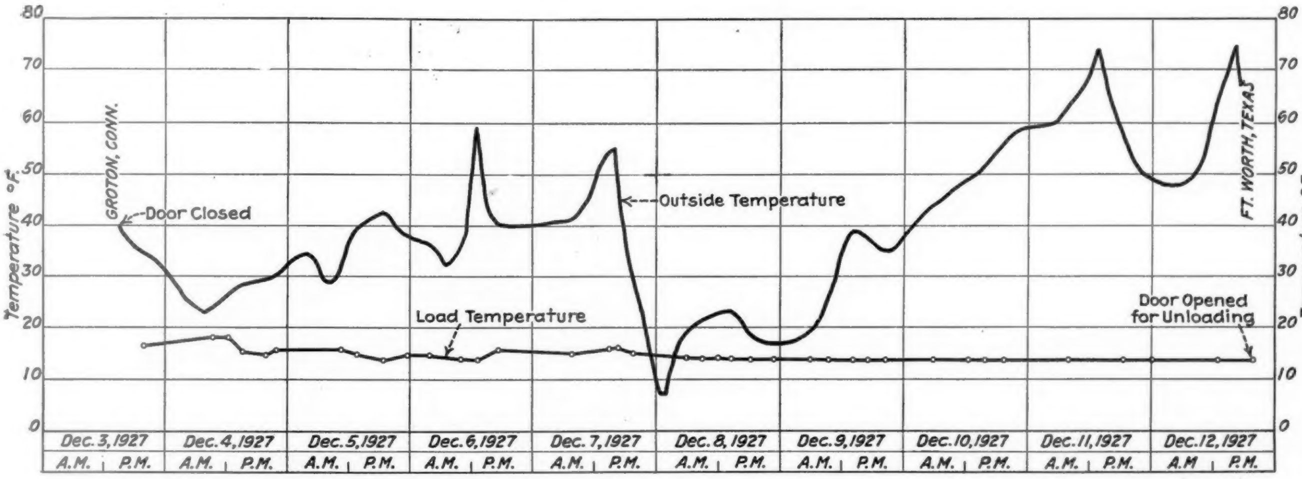
The operating cycle of the apparatus may best be explained by reference to one of the drawings in which is shown diagrammatically the adsorber, condenser and evaporator. Assuming that the silica gel in the adsorber has been activated, it will adsorb vapor from the refrigerant in the evaporator, causing a lowering of the temperature of the latter by the evaporation of the refrigerant. Evaporation of any refrigerant in the condenser is prevented by the float valve and the check valve, shown in the vertical pipe.

When the silica gel has become saturated with vapor, it is heated by means of a gas burner and the refrigerant vapor is driven out of the silica gel, passing to the condenser where it is liquefied and returned to the evaporator by the float valve. The horizontal check prevents the entrance of vapor to the evaporator. When activation of the silica gel has been completed, the source of heat is removed and, as soon as it has cooled sufficiently, the adsorption phase begins automatically. In actual operation, the heating period is much shorter than the adsorption period, and by dividing the adsorber into two sections and heating these sections alternately, continuous refrigeration is produced. As actually constructed, the silica gel is contained in many tubes of small diameter to effect a rapid heating and cooling.

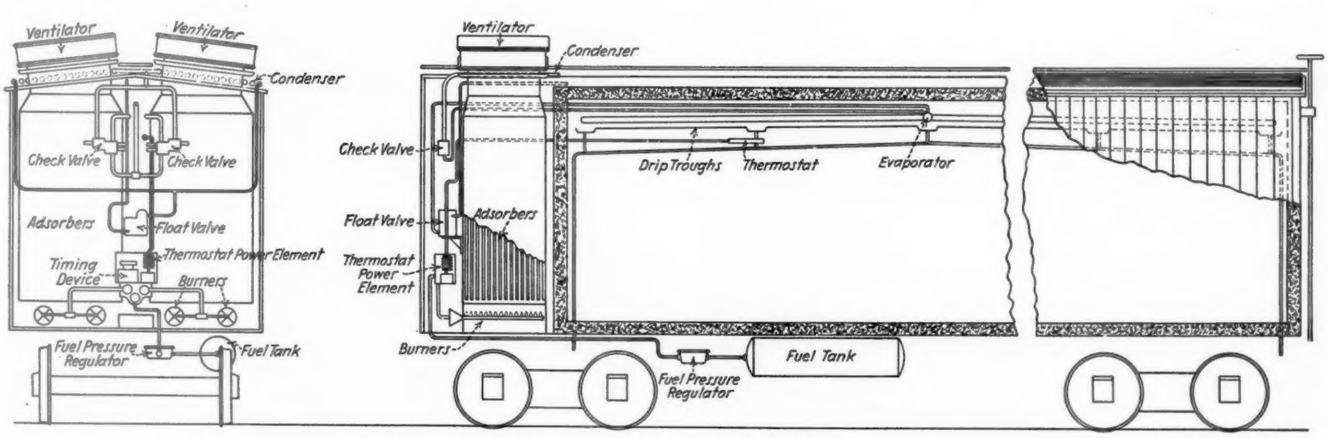
The arrangement of the apparatus as applied to the refrigerator car is shown in one of the drawings. The evaporator, consisting of a series of parallel pipes running longitudinally of the car and connected to a transverse header and containing liquid sulphur dioxide, is suspended close to the ceiling of the car. Below these pipes are suspended a series of small troughs arranged to catch and carry off condensation from the pipes, thus keeping the lading dry.

The condenser is of the air cooled type and consists of a series of pipes mounted on the roof of the car and protected from the direct rays of the sun by a covering, which at the same time permits free circulation of air over the condenser.

The two sections of the adsorber are placed at one end of the car and outside the insulated car body. The groups of vertical tubes containing the silica gel are placed in insulated fireproof casings provided at the top with ventilators to give a rapid upward movement of air, or products of combustion, from the gas burners. The burners which furnish the heat for activating the silica gel are placed below the tubes. The float valve is mounted in front of the adsorber and the two manifolds containing the check valves are just above



Temperature observations taken on a load of fish from New London, Conn., to Fort Worth, Texas

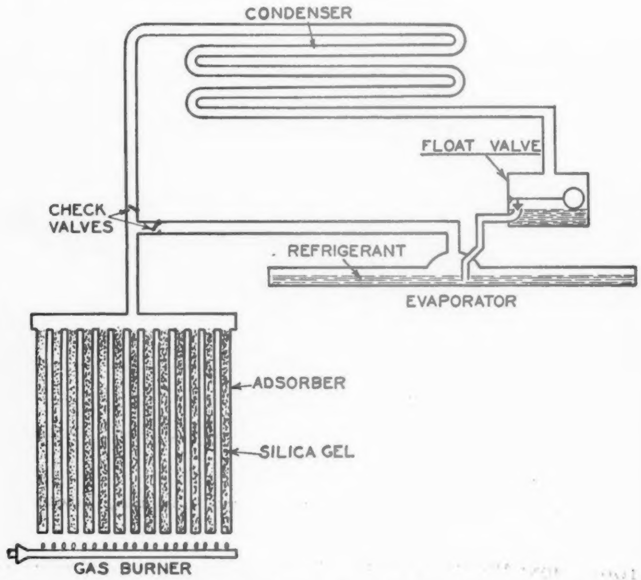


The silica gel system applied to a refrigerator car

the float valve. The fuel used for heating is carried in tanks suspended under the car body, and is fed to the burners at reduced pressure through a pressure regulator.

This arrrangement is based on 40 years experience with the Pintsch compressed gas system for lighting passenger coaches.

The operation of the system is effected entirely by lighting and extinguishing the burners alternately and



Diagramatic sketch showing the arrangement of the silica gel system

at the proper intervals. This is accomplished by a device operated by pressure obtained from the fuel, and is indicated in the drawing showing the arrangement of the apparatus, as mounted below the float valve. This device operates at a slow but definite speed and admits gas to the burners for fixed periods and at definite intervals. The gas is ignited at the burners from a small pilot flame which burns continuously.

The period of heating is of about 30 min. duration and the interval between successive heating periods is about 2½ hr. for normal operation. Each adsorber section is, therefore, heated for 30 min. every 5 hr. and is adsorbing sulphur dioxide vapor and producing refrigeration for about 4½ hr.

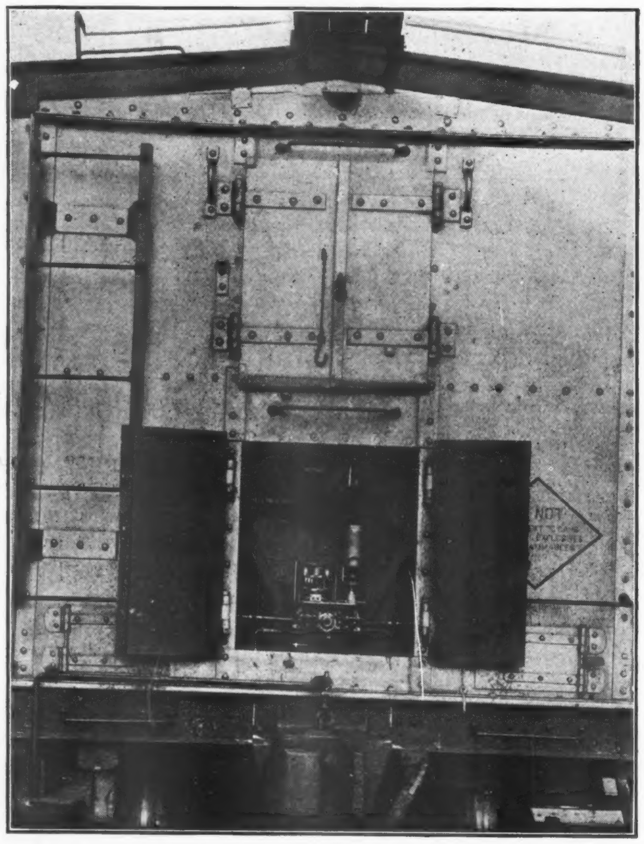
Thermostat control

For purposes of controlling the temperature in the car, a thermostat is used with its temperature-responsive bulb placed within the car. The power element is shown beside the timing device and operates a valve controlling the flow of gas to the timing device. When the car temperature falls to the point for which the thermostat has been set, the thermostat interrupts the flow of gas to the timing device, stopping the latter, and thus suspending the operation of the apparatus. When the car temperature rises above the thermostat setting, gas is permitted to flow again to the timing device, and operation is thus resumed. In this manner the car is kept at any desired temperature, and the refrigerating effect is produced automatically varying with changing atmospheric temperature.

The relative compactness of the silica gel apparatus permits increasing the lading space about 10 per cent. The adsorber occupies a space equivalent to that occupied by an ice bunker at only one end of the car. All of the space at the opposite end is available for lading. As the evaporator is placed above the lading and spans the entire length of the car, cooling is not dependent on the longitudinal circulation of the air and the height of the load may thus be materially increased.

In the case of the iced refrigerator car, no control of the temperature is possible, aside from adding salt to the ice, when a somewhat lower temperature is obtained.

Setting the thermostat of the silica gel system to the desired temperature, automatically holds the car to within a few degrees of this temperature. Thus,



Bottom ends doors to the refrigerating compartment opened to show the thermostat and control equipment

whether 20 deg. is desired for a shipment of frozen fish, or 40 deg. for cantaloup, a simple adjustment, guided by a pointer on a temperature scale, is all that is required.

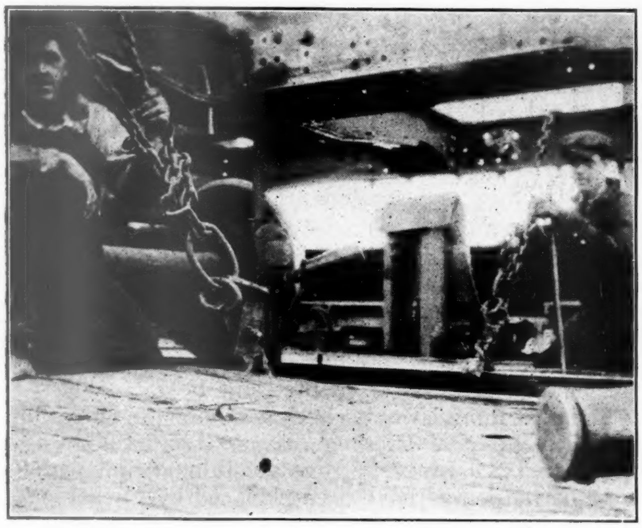
Tests have shown that the temperature variation throughout the length of the car is not more than two or three degrees. In the case of an iced car with end bunkers, the temperature at the center of the car is always several degrees higher than that at the ends, and the length of the car is limited by the temperature that can be maintained at the center. The overhead arrangement of the evaporator in this new car makes possible an increase in the length of cars without affecting the uniformity of temperature.

The fuel tanks with which the car is equipped have storage capacity for sufficient fuel to maintain operation for seven or eight days under summer conditions and ten or twelve days with moderate outside temperatures. The car can be precooled in from eight to ten hours.

Rail clamps used in straightening bent underframes

IN straightening freight car underframes that are badly bent out of line, the usual practice is to set them in a jacking stall. However, this is not always possible and when obliged to repair such cars on the open track, the method shown in the illustration will greatly facilitate the work.

Large clamps of ¾-in. by 3-in. steel, connected by a triple ring arrangement at the top, are made to hook over the ball of the rails. The two sections of the clamps, 12 in. in length, are joined by a ⅞-in. bolt in the middle and the lower end twisted half around and bent at right angles to fit the rails. By placing these hooks over the



Chains and rail clamps used to straighten bent underframes

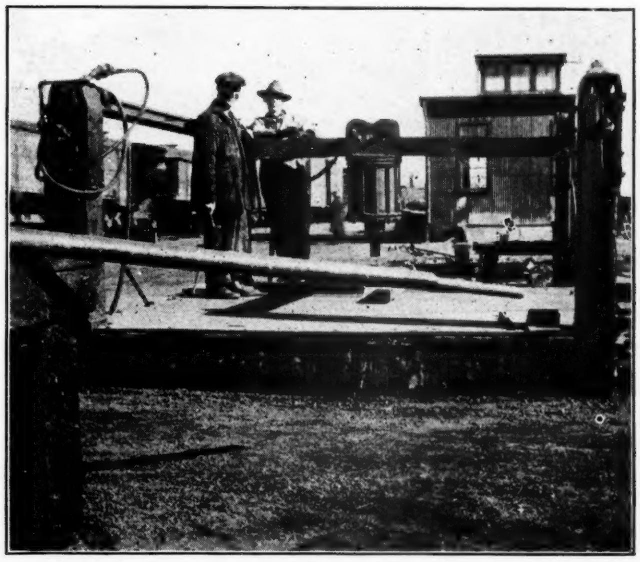
rails and passing chains over the underframe of the car, the latter may be held firmly in place while being jacked up at any given point. Usually a turnbuckle made from an old truss rod, on each end of which a hook is formed is used with each clamp in order to permit tightening the chain at any time.

If it is desired to raise or pull down a bent center sill, the clamps are placed near the highest point of the bent sill and after heating up the point which is out of line, jacks are used at the lowest point to straighten the sill.

In raising the end of a side sill, which is often dropped from a point near the trucks, a good method is to place a heavy piece of timber across the top of the center sills and the side sill just back of the highest point. A chain may then be passed from the rail clamp to the timber and tightened by the turnbuckle. When a jack is set under the end of the sill, the pressure will be vertical and the sill will not twist sidewise, as it would were the timbers not used.

A steel press for straightening flat material

FOR straightening steel ends and other material with a broad flat surface at the Denver shops of the Union Pacific, the adjustable air press, shown in the illustration, is found very useful, as any point on the surface of the material may be readily reached with the air cylinder. It is constructed with a heavy steel plate, 10 ft. square and placed on a foundation made of 8-in. by 10-in. timbers. A heavy post, 5 ft. in height at each corner, supports two rails one on each side. The cross beam

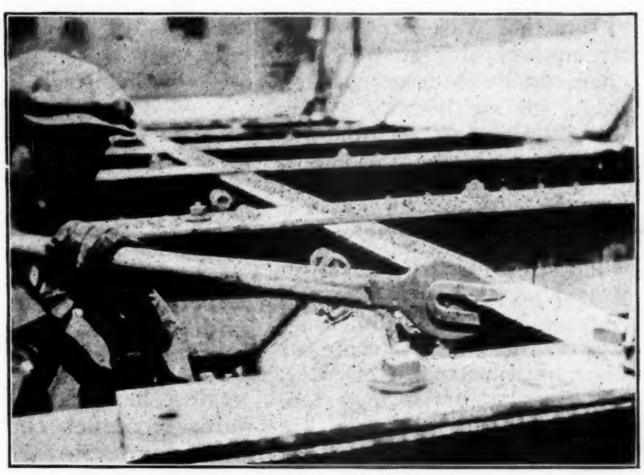


A clever arrangement for straightening large pieces of flat material

which supports the cylinder moves on these rails. Rollers 12 in . in diameter are at each end of the cross beam. As the cylinder moves over the cross beam, it is easisly adjusted to any spot on the 10-ft. square surface.

The car men's friend

IN repairing steel coal cars at the Denver shops of the Denver & Rio Grande Western, the "dog," shown in the illustration, has been found useful in straightening light steel flanges of ¼ in. or less. The straightening is usually done cold. The dogs are made by heating and



A tool used for straightening thin car parts

closing to a ¾ in. opening, the jaws of No. 4 alligator wrenches. A three to four-foot length of pipe is then slipped over the wrench handle, hammered down and welded. The teeth of the alligator-dog prevent slipping. The tool saves the muscles of the carmen from receiving innumerable jolts that would be sustained in swinging a sledge.

If I were repairing leaf springs

"Sydney Dunn" gives some worthwhile suggestions as to how the blacksmith shop should repair leaf springs

IF I were repairing leaf springs, it seems to me that this thought would occur—"Why does the quantity of springs to be repaired never decrease instead of increase, and is there a law of nature demanding that a regular percentage of them must break?" The obvious answer would be that the design must be somewhat near right, for all of them do not break. If they all broke, we could lay the blame on the design. Therefore, making allowance for variations in the service on the same class of spring, I find that the breakage is not in direct proportion to this possible variation. Looking further, I find that one companion spring broke and the other did not, or a similar spring in light service broke while one in heavy duty gave long service. Examination of the springs shows that the breakage occurs in various leaves at different places in the assembly.

From these facts, evidently my methods of manufacture and repair must be very slip-shod or erratic. Where do these errors occur? I use spring steel according to specification. I have a good punch and shear, a nibbing machine, a good burner in the furnace, a forming machine, a tank of oil and a banding machine. Of course, this is the same equipment that I. M. Rusty has on the P. D. & Q. where I learned my trade years ago, and Rusty learned the trade from his father, but I hear the P. D. & Q. breaks a lot of springs too. Something, or things are wrong. What, and where are they?

SYDNEY DUNN says, "If the steel manufacturer tells you that the type of steel used should have a certain heat and draw, he means what he says—and he don't mean maybe."

"I would get rid of all welded or folded spring hanger seats. Spring steel contains too much carbon to weld or work in this manner."

First, I would look over the specification for the steel and perhaps find that the carbon range is too great, in our case it has more than 10 points leeway. How can I make each leaf uniform in hardness when one batch of steel has, say, .92 per cent carbon and another 1.10 per cent carbon? To remedy this my specification for the steel would be so written that it would not allow more than a 10-point (.10 per cent) carbon spread. Of course, I know that it is considered economy to order two or three spring bars at a time, but if larger quantities were bought at one time, the carbon range might be more uniform because of having them all rolled from one ingot or at least from the same heat.

The next thing I would check would be the uniformity of thickness of the spring leaves. Leaves that have been in service for some time get thinner and perhaps some of the leaves have been replaced by thicker ones, presumably to stop the breakage. I would check the spring with the original design to make sure of this. I know the thicker the leaf is, the greater the fibre stress becomes for a given deflection. Perhaps that is why the thick leaves are the ones which break.

I would then try and get rid of all welded or folded hanger saddles or seats. Spring steel contains too much carbon to weld or work in this manner.

I would give my furnace the once-over

I would now give my furnace the once-over, paying attention, of course, to its capacity, and as to whether it could heat spring leaves without too much pushing, also making sure that the flame could not come closer than eight inches to the spring leaf. Two burners at medium capacity are better than one at full capacity. This insures uniform temperature throughout the hearth and allows for better control.

Instead of having narrow high doors as on a forging furnace, I would change them to long, low doors, about eight inches high, which flap outward and form a sill when they are opened. They can be of solid cast iron, unlined. This type of door is so easily handled that its opening and closing is done quickly, which is in its favor, as the furnace can be kept at a more even temperature.

In order to form the leaves to the proper curvature without strain they must be heated to a higher temperature than is good for the steel structure, if it is allowed to remain in that condition in the finished spring. For carbon spring steel this forming temperature is between 1,650 deg. and 1,700 deg. F. After forming the leaves they should be banked or piled on their edges and allowed to cool black. The reason for this is easily explained. The temperature at which the finest texture or grain size occurs is at approximately 1,475 deg. F. This is also the proper hardening temperature, for at this point the greatest hardness and strength is obtained. These are what we want, together with fine texture. These three desirable features will be secured automatically by proper heating and quenching. Now, by heating the leaves beyond 1,475 deg. F., the grains grow larger in proportion to the rise in temperature and they will retain that size whether quenched or cooled slowly. This structure is weak and non-uniform and altogether undesirable. We, therefore, allow them to cool slowly which will relieve forming and rolling strains and at the same time normalize the steel.

I would then carefully place the formed leaves on their edges, in another smooth bottom heating furnace, having an even temperature of 1,500 deg. F. (it is better to go a little above 1,475 deg. F. to allow for cooling in handling than to heat only to 1,475 deg. F. and allow to drop below it), from which temperature I would quench them quickly in circulating oil having a temperature of about 100 deg. F. This is done by installing a bank of coils through which the oil is pumped and allowing water to run over the coils to cool the oil.

This method will give leaves of uniform structure and hardness, but they are too hard and brittle for service, so I would place them in a salt bath, or in another furnace for about one-half to one hour at a temperature of 500 deg. F. where they are all tempered or drawn uniformly. This removes brittleness. Drawing by the flash method is crude, and no uniformity can be obtained by using it. It is wholly undesirable.

I would carefully inspect each leaf

After this I would inspect each leaf and clean it of all scale or oxide. To do this I would have a broad face, slow moving, carborundum wheel over which each leaf would be passed for this purpose. On the side of this wheel I would round off the sheared edges of the leaf, especially the two top edges where they are bound to rub on the next leaf. This will prevent each leaf from digging into its mate and causing it to weaken at this point. The niche caused by this digging action will also catch on the adjacent leaf if the spring happens to be deflected more than the average, thus making the leaves buckle and break. Loose bands are generally caused by failure to remove the scale and rust. When the spring is in service the scale pulverizes and works out from between the leaves and, naturally, the leaves loosen in the band—the band does not loosen on the leaves.

I believe bands of soft, strong material are needed

I believe I would have to put the bands on the spring by the present method, but I do not like the idea. It is not right. The hot band draws the temper on the spring wherever it touches, because it is hotter than the drawing temperature used on the leaves. Another point: a band is more than half broken when it is shrunk on the spring, due to the shrinkage stresses of the iron. I believe I would experiment along this line and try to find a soft strong material for bands which I could place on cold, and press it to shape and size hydraulically.

I know that by doing all the above, my repairs would decrease, and if some of these springs were too stiff or continued to break I would use a better material which would make a stronger and more fatigue resisting spring. Chrome vanadium steel is the best spring material we know of today and by using it I would overcome these faults. The only difference in the treatment of the leaves would be slightly higher temperatures; namely, forming, 1,700 deg. F. to 1,775 deg. F.; quenching, 1,525 deg. F., and drawing, 700 deg. F.

It is assumed, of course, that the forming, heating and drawing furnaces, or salt bath are equipped with thermo couples and pyrometer. One direct-reading 2,000 deg. F. pyrometer is sufficient for all three, providing that a multiple switch is used in conjunction with it. This pyrometer and switch should be enclosed in a dust-proof case suspended on light coil springs, in a convenient place away from direct furnace heat.

In using pyrometers, it should never be taken for granted that they are in first-class shape. At regular periods, say every week, the thermo-couples and pyrometer should be tested. The pyrometer very seldom becomes erroneous, but it is always safe to have a portable or extra one handy for testing purposes. The thermocouples and leads are easily checked by having an extra one with leads which can be used for that purpose.

A point to be remembered is, that if the steel manufacturer says that the type of steel used should have a certain heat and draw, he means what he says and not maybe. Variations in temperature of 25 deg., 50 deg. and 100 deg. F. are not conducive to good practice, and the final results obtained are in proportion to the care and understanding used in the processing.

Aside from the mechanical equipment of a spring shop, three furnaces, or two furnaces and a salt bath, pyrometer and cooling system for the oil are all the equipment necessary.

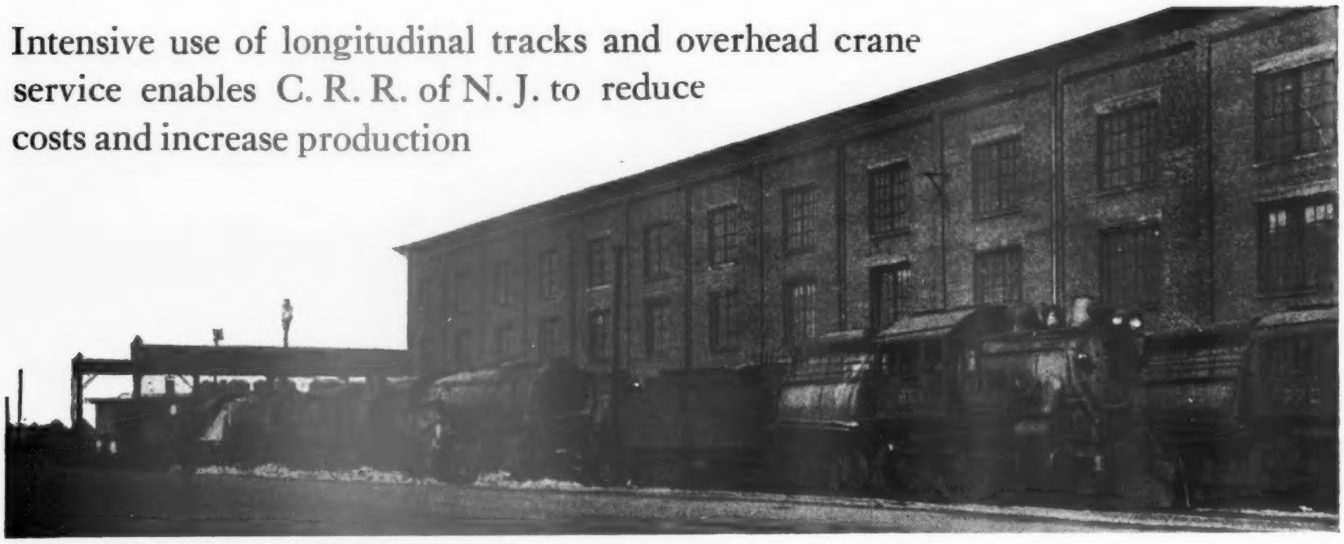
Vises.—The universal double swivel vise, which revolves upon two distinct complete circles, adjusting itself to any degree of these circles quickly and positively, is one of the types of machinists' and toolmakers' vises represented in catalogue No. 10 issued by the Yost Manufacturing Company, Meadville, Pa. The Yost drill press and pipe vises also are illustrated.

Journal Bearings.—The SKF Industries, Inc., 40 East Thirty-Fourth Street, New York, describes in its catalogue No. 187 the SKF journal bearing for railroad equipment. This bearing is a self-contained and self-alining unit. No internal adjustment is required to the bearing itself, and complete freedom of alinement is assured in passing over rail joints and track irregularities. Cross-sectional drawings clearly illustrate these features of the bearing. The closed-up construction of the journal box excludes considerable foreign matter such as water, grit and abrasive.

Alloy Irons and Steels.—Several pieces of literature on alloy irons and steels have been issued by the International Nickel Company, 67 Wall Street, New York. A four-page bulletin gives a non-technical description of the improved physical properties secured by the addition of Grade F nickel to gray cast iron, with a tabulation of the physical and mechanical characteristics of the alloy iron as determined by laboratory investigations and tests in the field. Bulletin No. 11 presents detail data on the relative machinability of alloy and carbon steels, and a chart, printed on a substantial grade of cardboard, illustrates the approved foundry practice for adding nickel and chromium in the ladle or cupola spout.

Spot system of locomotive repairs

Intensive use of longitudinal tracks and overhead crane service enables C. R. R. of N. J. to reduce costs and increase production



Station No. 1—Locomotives are stripped outside of the shops.

DURING the past year the Central Railroad of New Jersey has made a number of radical changes to the system of repairing locomotives at its back shops, Elizabethport, N. J. This repair point is located on the main line about 11 miles from its Jersey City, N. J., terminal. The Elizabethport back shop is operated in conjunction with a 24-stall enginehouse, and the plant also includes large shops for the maintenance of freight and passenger cars.

The principal locomotive back shop buildings and repair facilities were erected and installed in about 1900. The erecting, machine and boiler shops are all located in one building, which is 700 ft. long by 148 ft. wide. The erecting shop extends one-half of the entire length of the building and occupies a floor space approximately 82 ft. in width. The machine sh tool room, and boiler shop occupy the areas as shown in the floor plan drawing of the locomotive repair shop.

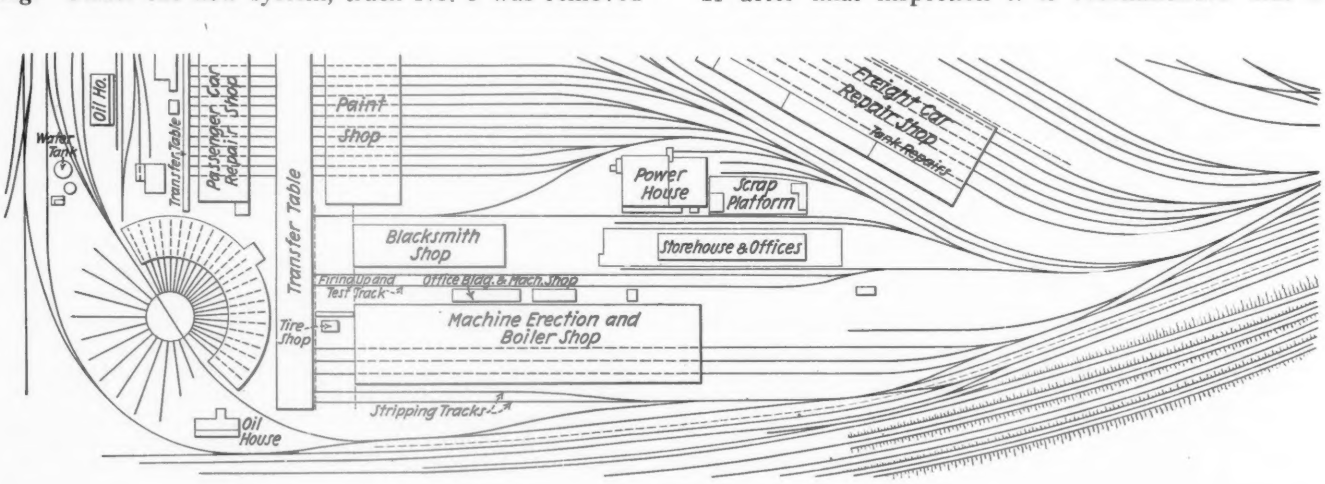
Previous to the installation of the spot repair system, the erecting shop was provided with three tracks, spaced 25 ft. center to center, which extended the entire length of the shop and out both ends of the building. Under the new system, track No. 3 was removed except for about 200 ft. at the west end of the shop. This remaining section of track is now used for wheel repairs.

Tracks Nos. 1 and 2 extend from the transfer table, through the erecting shop to a ladder track, as shown in the plan of the repair tracks and buildings. The transfer table serves the locomotive shop and the passenger car repair and paint shops.

Determining class repairs for incoming locomotives

The works manager is notified in advance by the superintendent of motive power what locomotives are due for repairs and what repairs are required. The superintendent of motive power bases his estimate on a combined study of the enginehouse work reports, inspection reports and mileage. The decision by the superintendent of motive power as to what class of repairs a locomotive is to receive is rigidly adhered to, except in occasional instances when the shop inspector finds some condition after stripping and had not previously reported that should be remedied when the locomotive goes through the shop.

If after final inspection it is recommended that a



Layout drawing of shop repair tracks and buildings

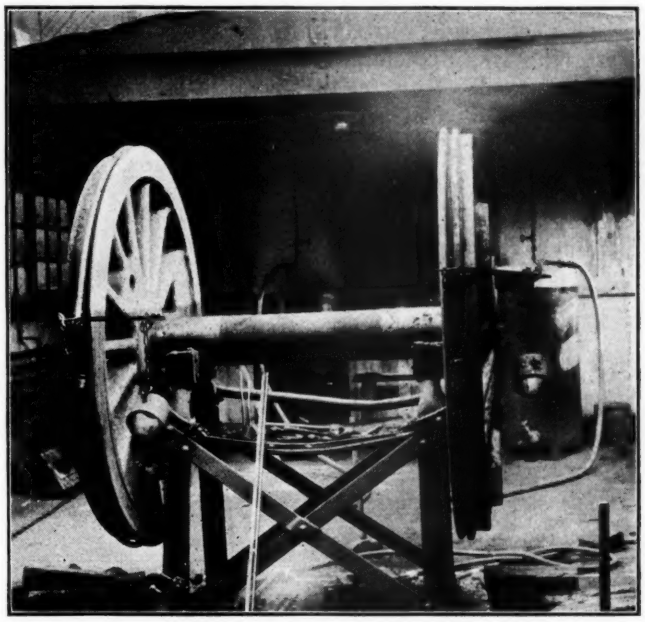
locomotive be given class two instead of class three repairs, or some other change in classification of repairs is recommended, an additional inspection is made by the works manager and interested department heads. If they agree with the shop inspector, the superintendent of motive power is notified, who authorizes the additional repairs if they meet with his approval.

This system of determining the class of repairs for locomotives coming into the back shops, makes it essential that the enginehouse work and inspection reports be accurate and that the information be complete.

The works manager holds a meeting each day of the supervisors of the locomotive shop to discuss the progress being made on each locomotive going through the shop and to plan for the handling of work coming into the shop. In addition a material committee composed of the boiler shop, blacksmith shop, machine shop and erecting foremen, and a representative of the stores department, meets once each week to review the instructions from the superintendent of motive power and the shop inspector's reports, to ascertain the amount of work and material required for incoming locomotives. The works manager acts as chairman of this committee. In addition to the representatives of the stores and locomotive shop, representatives from the passenger and freight car departments also serve on this committee. At the material committee meetings the stores department representative checks his inventory records as to the quantity and kind of material needed and if the material is not in stock, gives an estimate as to the time required to get it.

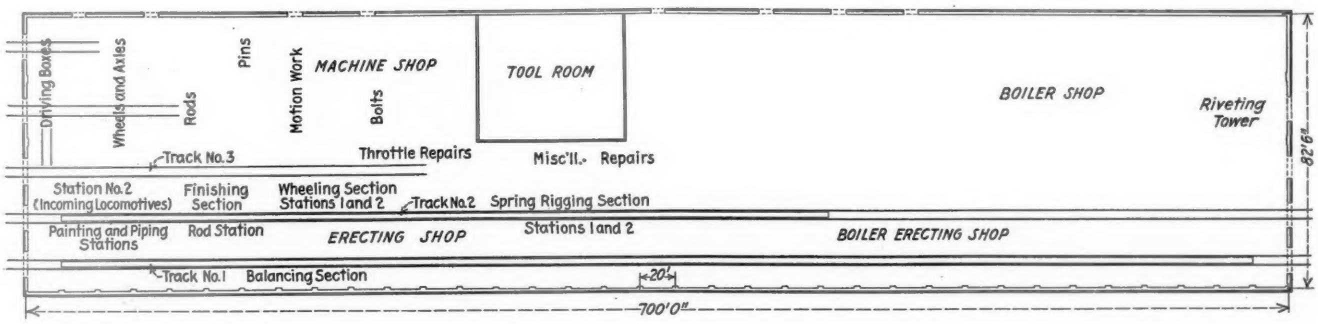
Routing locomotives and material through the shop

Referring to the drawing showing the plan of the buildings and repair tracks, incoming locomotives are stripped outside on the two tracks beside the main building. This is station No. 1. These tracks extend then loaded on skids and taken to the lye vat, or are stored on the north side of the shop, next to the firing-up track. The various parts are sorted and arranged on the skids according to destination. Each skid is numbered to simplify instructions to the operator of



Interior of the tire shop—mounted wheels are placed on the trestle by overhead crane through an opening in the roof

the electric lift truck as to the destination of the various parts. Only parts from the same locomotive are placed on a skid. The gang foreman inspects the parts on each skid. For example, if skid No. 30 is loaded with pipe from locomotive No. 329, he gives an order



Location of repair sections and stations in the locomotive shop

under an overhead crane to the transfer table. The area covered by the crane extends the full width from the end of the locomotive shop to the edge of the transfer table and from the southeast end of the transfer table to the passenger car paint shop.

When a locomotive arrives at Station No. 1 which requires repairs to the tender, the latter is taken to track No. 1 in the freight car repair shop where all repairs are made to the tank, bunker, draft gears and trucks. Stoker repairs are made in a separate department in the locomotive shop.

Parts removed from the locomotives at station No. 1 are marked with tin tags showing the number of the locomotive from which they were removed. They are to the truck operator to take skid No. 30 to the pipe shop. The pipe shop foreman knows from the information on the order, the locomotive from which the pipe was removed and keeps the material together while it is being routed through his department.

This system of grouping parts from one locomotive and routing them together through the shop, is followed as far as possible. It has been found to be advantageous in tracing material, checking to see whether repair work on different parts is progressing according to schedule, and in allocating repair costs. Finished material is loaded on skids which are spotted on the erecting shop floor, as shown in one of the illustrations. until needed. Continuing the example given in the pre-

ceding paragraph, when the erecting shop foreman is ready to apply the pipe work to locomotive No. 329, he instructs the lift truck operator to deliver skid No. 30 direct to the locomotive. This places the material where it is needed and can be applied with a minimum of handling by the pipe fitters. The same procedure is followed by the machine shop foreman and other department heads, instructions being given as to the material station, machine or bench at which the material is required.

The erecting and machine shops

Station No. 2 is the unwheeling station. It is located inside directly opposite the machine shop bay. Locomotives are moved from station No. 1 via the transfer table to this station. All parts have been removed except the wheels, boxes and cabs at the first station. These are removed at station No. 2. Driving boxes are relined and rehubbed with bronze in a small building located between the transfer table and the machine shop. Steel plates are welded to boxes worn below size and are machined to required dimensions. New tires are applied in the same building. Wheels and tires, both mounted and unmounted, are stored in the area adjacent to the tire shop. Thus, if one pair of tires from a complete set is below gage limits, a second pair of tires can be found, quickly applied and turned to suit the rest of the set.

The interior of the tire shop is shown in one of the illustrations. The wheels are rolled outside the locomotive shop from station No. 2 and transported by crane to the tire shop. A large opening is cut in the roof of the building so that wheels mounted on their axle can be lowered directly onto the trestle shown in the illustration. The burners are gas operated, gas being furnished from a small generating plant, part of which can be seen in the background to the rear of the wheels.

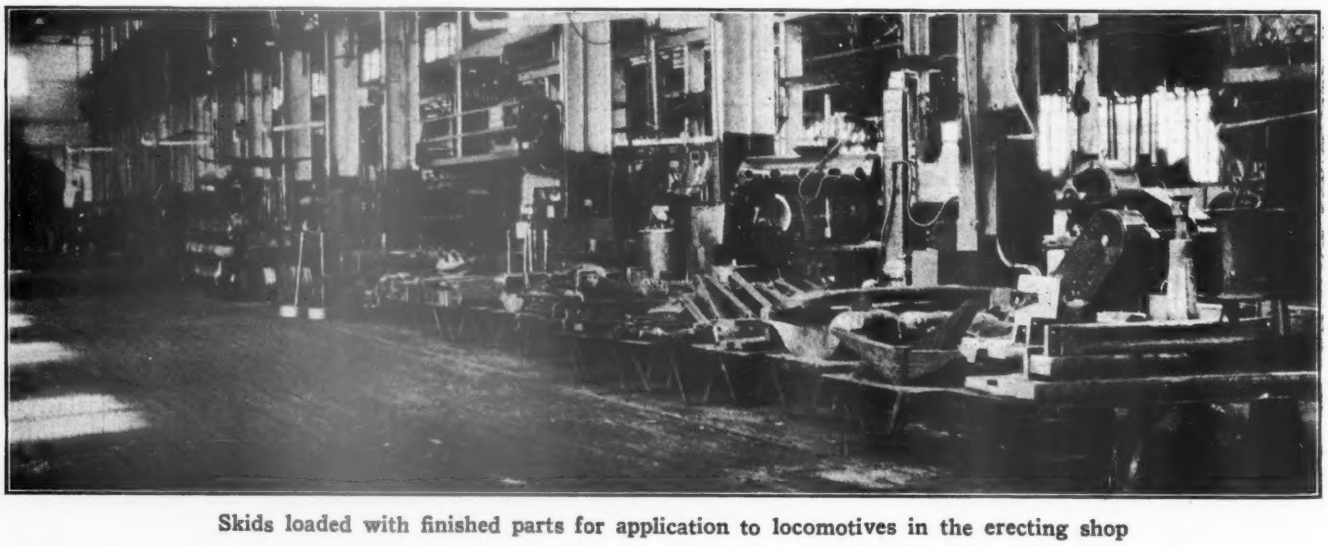
Driving boxes and wheels are routed from this shop directly to the machine department. The machine tools for finishing boxes and turning tires are grouped at one end of the machine shop directly opposite station No. 2 in the erecting shop, in such a manner as to afford a minimum of handling from one machine to another. On completion of the machine work, the driving boxes are applied to the journals and the assembled wheels, axles and boxes are placed on a short track transverse to the shop and thence by crane to the wheeling section where they are placed in position to receive the locomotive.

After the locomotive has been unwheeled it is picked up by an overhead crane and placed in the balancing section on track No. 1, where all the necessary boiler work, flue setting, frame repairs, cylinder repairs, etc., are performed.

Balancing section provides flexibility in routing work through the shop

Doubtless many of the readers have assumed from what has been said in the preceding paragraphs that the various stations are arranged in order from one end of the shop to the other. This is not the case. Each locomotive goes out of the shop at the same end where it was brought in. Although this apparent return movement or "back track" from the balancing section appears somewhat illogical, especially after studying the layout drawing of the repair tracks and buildings, it is, nevertheless, the most important feature in the successful operation of the spot repair system at the Elizabethport shops.

Aside from the short length of track No. 3 at station No. 2, which is used for wheel repairs, only tracks Nos. 1 and 2 extend the entire length of the shop. All of the other stations, including the balancing section, use the first two tracks. This does not include the firing-up and testing stations, both of which are outside.



Skids loaded with finished parts for application to locomotives in the erecting shop

Locomotives from Station No. 2 go to the balancing section on track No. 1. This section derives its name

from the fact that its primary function is to balance or regulate the output of the shop. In this section locomotives coming in for class four or five repairs can be routed around those receiving class one or two repairs and turned out of the shop ahead of the order in which they came in. In addition, repairs to locomotives required for service sooner than others can be run around other locomotives going through the shop through the functioning of the balancing section.

This section includes all of track No. 1 to the boiler shop and is the turning point in the routing of the locomotive through the shop. This arrangement leaves the entire lower half of the erecting floor free for heavy boiler repairs. It also keeps all the repairs requiring machine tool work opposite the machine shop.

Progress of repairs from the spring rigging to the finishing stations

Spring rigging stations Nos. 1 and 2, wheeling stations Nos. 1 and 2, and the finishing section are located on track No. 2, from the boiler shop to the end of the erecting shop in the order named. The finishing section includes the rod, pipe and painting stations. The two spring rigging stations, the wheeling stations and the rod station of the finishing section are located directly opposite the relative departments in the machine shop. This arrangement greatly facilitates the handling of finished material to the erecting floor.

No section or station name or number is assigned to the boiler shop. The boiler repairs, although occupying the lower half of the erecting shop floor, are handled as a separate department, the same as the machine shop, etc. Locomotives are moved by overhead crane from the balancing section on track No. 1 to either one of the two spring rigging stations on track No. 2. The next step is to one of the two wheeling stations. The object in having two stations each for applying spring rigging and wheels, is to allow flexibility in the handling of different classes of engines, it being easier, for example, to wheel switch engines than

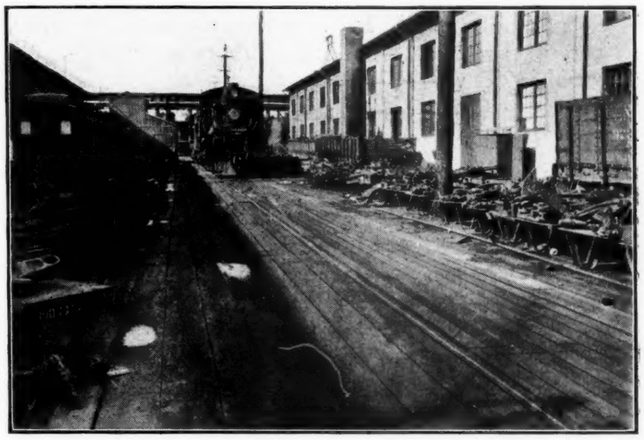
The boiler repair shop—This photograph was taken from the wheeling station

to wheel Mikado type locomotives. Cabs are applied in the wheeling section. On completion of this work, the locomotive is moved from the wheeling section to the rod station in the finishing section and thence to the piping and painting stations. The firing-up and testing stations are located on the northwest side of the shop. Locomotives are moved from the finishing section to the firing-up station via the transfer table.

An electric truck equipped with an 18-ft. boom is available for service at any of the various sections or stations in the erecting shop for applying air compressors, side rods, etc. This truck releases the overhead cranes for heavy service.

Spot system requires specialization of working gangs

With the installation of the spot system, it was found necessary to reorganize the working force into gangs of specialists, each gang being held responsible for the



The firing-up track—Note the skids loaded with parts waiting to go through the shop

same kind of work on each locomotive going through the shop. The erecting force, including boiler and flue work, is divided into six gangs, each under the supervision of a foreman. The gang foremen report to the erecting shop foreman.

Gang No. 1, which is located at the balancing station, renews all caps, staybolts, flues, boiler patches, ash pans and front end arrangements. Gang No. 2 handles the refitting of binders and frame braces, and applies the boiler studs and all frame bolts. Gang No. 3 wheels the engines and applies the spring rigging, pedestal binders and brake rigging in the wheeling and spring rigging sections. Gang No. 4 does the piston, crosshead, valve and link motion work in the finishing section, rod station. Gang No. 5 applies the cabs, headlights, running boards, stacks, hand railing, cylinder cocks, cylinder cock rigging, couplers, pilots, steps and the main and side rods, as the locomotive moves through the wheeling and finishing sections. Gang No. 6 does all the pipe work including the injectors, bell ringers, throttles, lubricators, all air brake parts, sanders, etc., in the finishing section, pipe station.

Delivery of material

All material is delivered on material memorandums or orders, to designated stations in the shop. Each material station is designated by a number. Small metal signs, on pedestal stands, are provided at each material station for the guidance of the delivery man as well as the workman. Material memorandums or orders are placed in a small receptacle secured to the sign. The number of the station to which the material is to be delivered is marked on the order. Heavy material is stored under the overhead crane between the transfer table and repair shop buildings to facilitate handling.

The progress of all material through the shop is fol-

lowed up by a material man whose sole function is to keep a constant check on work going through the shop. He reports progress as well as all delays, to the machine shop foreman, and also at the daily staff meetings. Daily and weekly reports of material shortages are made to the stores department by the general foreman. These reports are checked with the stores department, which makes an investigation and if the material is in stock, sees that deliveries are made, or in case the material has to be ordered, a delivery date is assigned.

The entire system of delivery of material, both finished and unfinished, has been co-ordinated with the object of minimum handling. Whenever possible, the material is delivered directly to the place where it is to be used in the machine, or to the locomotive on which it is to be applied.

Spot system has effected saving over former system

At the present time the Elizabethport shops have an output of 26 classified repairs per month with a total force of 750 men. These figures, compared to the results obtained a year ago, show that the shop has obtained an increase in production of approximately 25 per cent. This was accomplished in the face of a reduction in force of 30 per cent. One year ago, the classified repair output was 20 locomotives with a total force of 901 men working 25 days per month.

Under the old system, 25 locomotives were placed in the shop and five gangs performed all the work on each locomotive. The introduction of the spot system, as stated in a preceding paragraph, necessitated the reorganization of the working forces into six gangs of specialists. This change not only was a big factor in reducing the cost of repairs, but the shop has also been able to turn out work of much better quality. Several innovations in the handling of repair work were introduced with the spot system. One of these was in the handling of boiler repairs. All the boiler work, including the application of flues, testing, frame repairs, cylinder work, application of frame bolts and firebox renewals, are performed with the boiler shell attached to the frame. Each boiler is filled and fired for test before the lagging is applied. This method of making repairs effected a saving of over 14 per cent over the old method in which the shell was removed entirely.

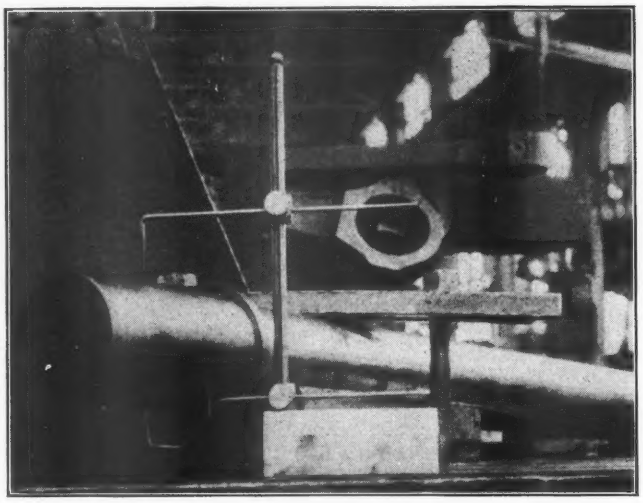
Jig for drilling piston and valve rods

By A. J. Flowers

Master Mechanic, Central of Georgia, Macon, Ga.

THE jig shown in the illustration is being used in the locomotive shops of the Central of Georgia, Macon, Ga., for drilling piston and valve rods. It is designed for use on a drill press and may be used for drilling one hole or a series of holes (used in cutting the keyway) in either valve stems or piston rods. The keyway may then be finished either on a milling machine or slotter. The jig consists of a taper block which is planed to suit the taper of the piston rod or valve stem key. A surface gage attachment is secured to the block as shown in the illustration which is made so that the two pointers will be in line with each other, irrespective of their distance apart. This feature is accomplished by milling or planing a slot in the stem of the surface gage in which the ends of the adjusting screws in the pointer holders are engaged. The ends of the adjusting screws are machined to suit the slot. This feature keeps the pointers in line at all times.

We find that this gage and block saves considerable time over the old method of lining up rods with shims



A surface gage attachment secured to the jig is used to see that the rod is in correct position for drilling

so as to enable the operator to drill a hole to the correct taper. The former method was a long operation. The surface gage eliminates the using of a square on the end of the rod to ascertain whether the rod is in the correct vertical position. This jig was developed and made by G. N. Cagle, machine foreman, and Leo Fetner, both of whom are employed in the Macon shops.

Hydraulic Pumps and Motors.—Hele-Shaw pumps and motors for the application of high pressure hydraulic power on a variety of machinery drives, including presses, broaching machines, testing machines, cranes, mechanical stokers, etc., are described and illustrated in catalogue C issued by the American Fluid Motors Company, Philadelphia, Pa.

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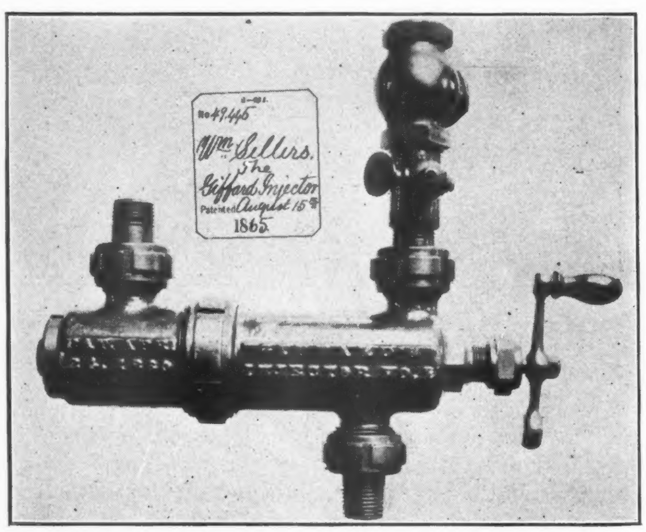


Gifford injector preserved in the National Museum, Washington, D. C. This is William Seller's patent model for an improvement patented four years after the original invention

Staybolt production in railway shops

Methods and types of machines generally used for the manufacture of crown staybolts

Part II

As previously mentioned in Part I of this article in some shops instead of squaring staybolt heads, the bolts are at the time of manufacture threaded their entire length. As this form of staybolt is not yet common practice in railroad shops, a description of their manufacture will be given.

When screwing this form of staybolt into the boiler, they are held in threaded socket wrenches made of tool steel, threaded to fit a certain size of bolt and hardened to increase the wear and reduce the danger of the threads breaking. A stop in the socket is set so that the bolt extends beyond each sheet about two threads or 1/6 in., or such amounts as shop practice dictates to allow for the beading.

The practice when applying the staybolts is as follows: The distance from the outside of the outer sheet to the inside of the firebox sheet is measured with a rule gage which is passed through the staybolt hole. This gage is graduated to show the length of bolt required plus the added length to admit of beading each end. The bolt is placed in the socket wrench and screwed into the boiler until the socket wrench comes flush with the sheet, after which the wrench is backed off.

In many respects, this is a desirable practice, as the bolts are located in the sheets allowing the correct amount for beading at each end. It is not necessary to cut off the bolt in the sheet, which is objected to by some boiler makers owing to distorting the threads of the sheet and bolts during the cutting-off operation. There are however, objections to this practice. It is necessary to keep on hand a large stock of bolts of the desired lengths, or provide means by which they may be economically cut off to odd lengths. However, when made by quantity production methods, the labor cost is comparatively low, also less material is required per bolt owing to omitting the square ends. This form of staybolt admits of economic manufacture direct from the bar, either on automatic screw machines or turret lathes.

Manufacture of staybolts on automatic machines

The single spindle automatic forming machine, Fig. 10, is the more suitable type of automatics for this work. This class of machine has the usual devices for feeding and gripping the bar, cut-off rests, stops to gage the length of bar fed and a single plunger for holding the threading die. The single plunger takes the place of the turret common to automatic screw machines. All of the operations are controlled by cams.

As machines of this nature would be kept on this special job, the lost time of changing the set-up is small. The changing from one length to another of the same diameter only involves the re-adjustment of the dogs controlling the length of stock fed and the fast speed movement. The changes should be made in about 10 minutes. Machines of this nature may be equipped with relieving attachments for cutting away the central portion of the bolt. The output of plain radial staybolts 7 in. long would be about 30 per hour, or relieved bolts about 23 per hour, less possibly 25 per cent idle time. As one man can operate four machines, the labor cost is low.

The cycle of operations for the manufacture of staybolts on an automatic machine is as follows: The bar is fed to the stop; the chuck tightens, gripping the bar; the bar is partly cut off by the front cut-off tool and at the same time the die head starts cutting the thread. The front cutting tool backs off and out of the way of the die head. The die head continues to cut and threads to about 1 in. past the previous nick in the bar. The die opens and backs off; the bar is cut off with the tool in the back cut-off rest. The chuck opens and the machine goes through the same cycle for the next bolt.

In the above description, it will be noted that the dies run over the first partial cut-off or nicking of the bar which prevents burrs or enlargements of the threads at either end, thus permitting the staybolt to be readily screwed into the boiler or socket wrench.

This form of staybolt is also made on turret lathes as shown in Fig. 11 or on a double die crown staybolt machine. The actual time of making the bolts on automatics or hand turret machines is practically the same. For a large shop where several automatics can be kept in operation, the automatics are the more economical. However, for a small shop where frequent changing is necessary owing to lengths and diameters, the turret lathes are, as a general proposition, the more desirable. The choice of machines is governed by the number of staybolts required; the higher capital cost and lower labor cost of the automatics, versus the lower capital cost and higher labor cost for the turret lathes.

Drilling tell-tale holes

For a shop in which a large number of staybolts are manufactured, it is generally economical to install special machines for the drilling of tell-tale holes owing to the fact that the first cost of a high production machine is not much greater than the several less efficient machines, such as drill presses, required to produce the same output per day. The special machines, owing to lower labor costs will, in most cases, warrant the greater investment.

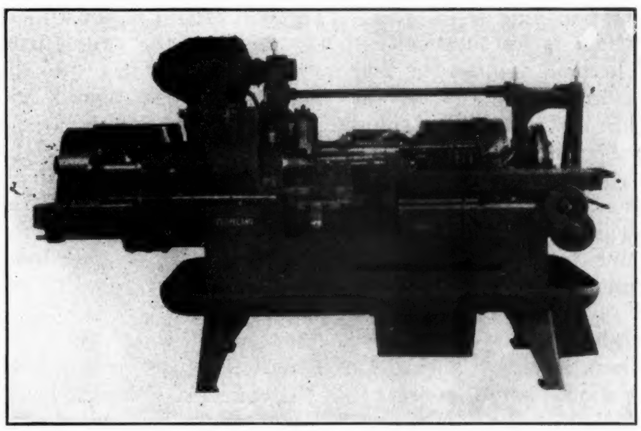


Fig. 10—An automatic machine for the manufacture of staybolts from bar stock

One of the most speedy machines now on the market

for this purpose has a revolving magazine in which 12 staybolts are held during the drilling operations and also a cage in which are held 12 drill spindles. The magazine and cage revolve at a uniform rate of about one complete revolution per minute. The bolts are held in the magazine by a cam-operated chucks the jaws of

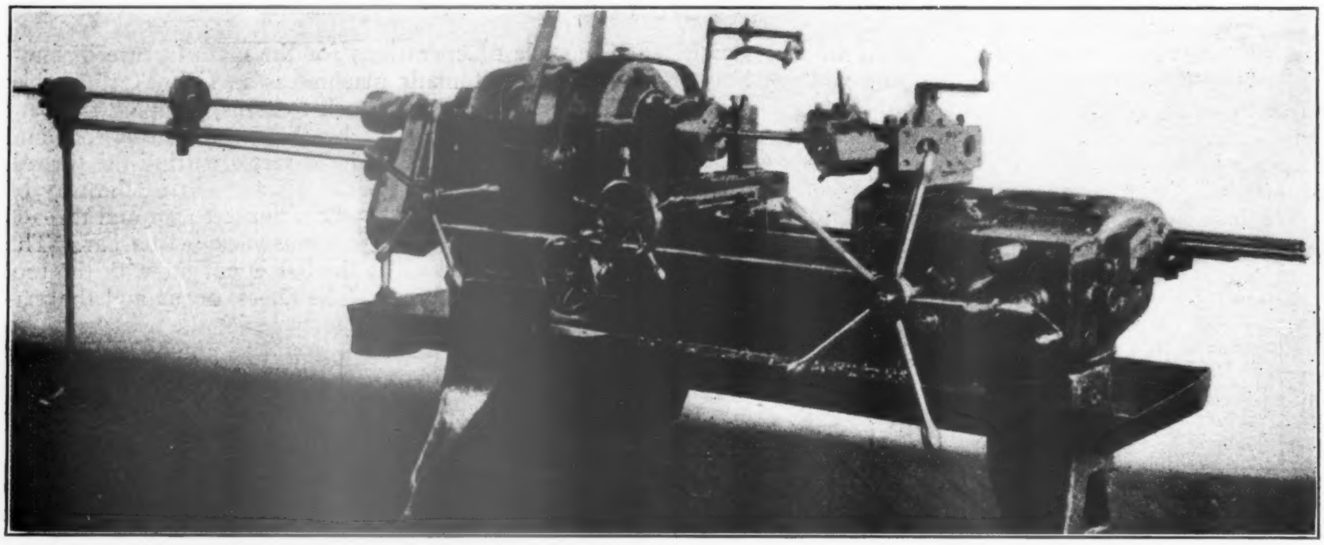


Fig. 11—Threading and cutting off staybolts on a turret lathe, thus eliminating extra handling of the bars.

which are serrated 12 per in., agreeing with the threads on the bolts, which prevents their pushing backwards during the drilling operation.

Thrust collars surround the quills on each spindle. The spindles are moved horizontally in their respective bearings. A roller which rides on a cam is attached to each quill. The stationary cam has three or more lobes. As the drill spindles and cage rotate, the cam forces the drill spindles forward drilling the staybolts a given distance as the roller rides up and over each cam lobe. The spindles are pulled back by springs. Each successive lobe of the cam is of a greater elevation for the purpose of drilling to a greater depth.

To explain the cam operations, the drilling of one staybolt will be followed. The bolt is laid in the chuck, which is automatically tightened in as the cage turns. The drill spindle for that particular station is fed to the work by the rise of the cam, drilling the bolt a certain distance. The spindle passes over the first lobe on the cam and recedes for the purpose of allowing the drill to clear itself of chips. As the cage further turns, it rides on the second lobe of the cam which causes the drill to drill the bolt still deeper. This is repeated for each lobe. After the drilling is completed the chuck holding the bolt in place opens and the operator removes the drilled bolt and applies a new one after which the chuck tightens and the machine goes through the same operations. While this explanation refers to one bolt, it should be understood that the entire 12 bolts are being drilled at the same time.

The drills are guided to the bolt center by a bushing located on the cage and are flooded with oil at all times. Owing to 12 staybolts undergoing the drilling operation at one time, the output is large.

Manufacture of crown staybolts

Two types of crown staybolts are in general use. The button head staybolt is made from bar stock slightly less in diameter than the root of the thread. The button at the head end, the squared end and the enlargement of the tread are upset and formed while hot by one operation in a forging machine. The point end is likewise enlarged in a forging machine to a suitable diameter for either threading without turning, or to a slightly larger diameter (about 1/16 in.) to admit of turning previous to threading.

This practice is, in some shops, modified by making use of stock the full diameter of the threads; that is, 1-in. bolts are made from 1-in. stock. The button head, the square end and in some cases the threaded portion are upset in a forging machine. The stock between the threaded sections at the point and the head end is re-

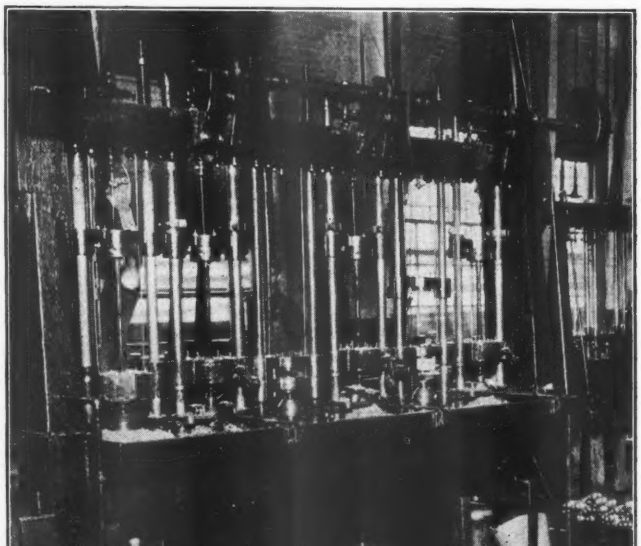


Fig. 12—Crown staybolt threading and turning machine

duced in diameter slightly smaller than the root of the thread by a turning operation.

Taper thread head end staybolts are forged from blanks similar to the button type.

Machining operations required for both types of crownbolts

The machining operations on the above mentioned crown staybolts compare as follows: The small stock

bolts require two forging machine operations. Unless great care is exercised in maintaining the forging dies in perfect alinement and in good state of repairs, the upset ends do not line with the center section, with the result that when threaded, the threads may not be concentric with the center section, which defect is, in some shops, objected to for fear of injury to the boiler sheet threads when applying. This method of manufacture takes less weight of stock and is generally lower in labor cost. With reasonable care in forging and machining, the method meets with the general requirements.

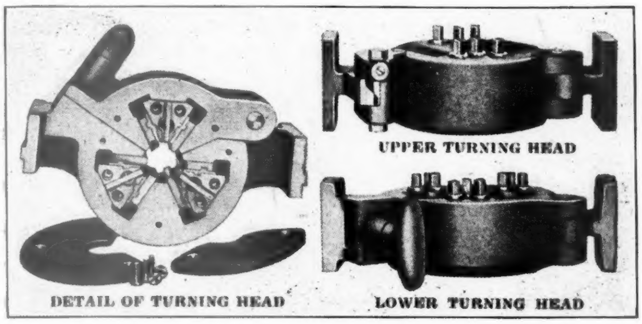


Fig. 13—Turning heads used on the machine shown in Fig. 12

When made from the larger bar stock, only one forging operation is necessary. However, the labor of reducing the central portion is added. The threads and the reduced section are readily machined in line. The relative cost of manufacture by either method is largely governed by the machines employed.

Turning and threading on special purpose machines

Owing to the large number of crown bolts required, special purpose machines are extensively employed for their manufacture. Fig. 12 shows one design of machine now used in several railroad shops. The general construction of this machine as far as the drive of the crown bolts, uprights, etc., are concerned, is similar to the machine shown in Fig. 9 in Part I of this article. As generally constructed, four of the six uprights are each equipped with two turning or cutting heads. The upper cutter head is for the purpose of turning the point end to the correct diameter for the thread. The lower head is for the head end in which the blank is turned to the correct diameter for the thread. The under side of the button head is faced, either flat or cupped and the flash left from the forging operation is removed.

The upper cutter head, shown in Fig. 13, may be opened for clearance when removing the blanks. The lower head, shown in Fig. 13, is of unique design. One half of this head is hinged and when closed, is securely held in position by a locking handle. The hinged front allows for opening while applying and removing blanks. Each of the heads are provided with adjustable cutting tools and the necessary backers or guides. These cutter heads turn the blanks in a very satisfactory manner.

Both of these cutter heads are adjustably held on two vertical rods admitting of setting either head to any location for different lengths of bolts. The two rods extend upwards to a common crosshead which is actuated by a power driven cam on a slowly revolving shaft located on the upper frame of the machine. Each individual cam is engaged by a clutch which is thrown in by pulling a lever. When the cam makes one complete turn, the clutch automatically disengages. Each of four turning stations of the machine are independently thrown into operation, the same as would be the case with four separate and distinct machines.

The two remaining stations are for the threading operations. They are each equipped with two self-opening die heads. The upper head is similar in operation to the commercial self-opening die head such as shown in Fig. 14. The lower die head is of a special design, equipped with an instantaneous trip operated by a trigger striking the flat surface under the button head end of the blank, which insures the thread extending close to the flat surface and preventing the chasers from striking this surface. Both of the die heads are raised by a friction belt and handle, the same as shown in Fig. 9. A floating socket drive for the bolts is preferably made use of to compensate for possible irregularities of the fitting of the square ends of the bolts in the socket drive.

Operations on the machine

In referring to the turning and threading operations, only one turning and one threading station will be considered. In considering the turning operation, it will be assumed, as is actually the case owing to the cam action, that two cutter heads are in the upper position; that is, the lower head is about 2 in. above the enlargement of the blank for the thread. The upper head is above the point of the blank. The hinged half of the lower cutter head is open.

The operator places the squared head of the blank in the socket which revolves the blank. He then closes and locks the hinged half of the lower cutter head and pulls the clutch lever which engages the cam, after which the two cutter heads automatically feed downward, turning the point end to the correct diameter, turning the head end to the correct diameter for threading, facing the under side of the button head and removing the flash from the outside of the head. After a small amount of dwell to insure a satisfactory facing of the under side of the head, the two cutter heads automatically raise at a rapid rate, when the cam disengages awaiting the next operation. The operator opens the cutter heads and removes the turned blank.

In the threading operation, the two die heads of the selected station are raised by pulling the handle attached to the friction belt. The squared end of the previously turned blank is entered in the revolving socket. The die heads are lowered, the lower die passes over the point end of the blank when in an open position and is closed before reaching the head end thread. The upper die is closed by a cam on the upward movement. The point and head ends of the blank are then simultaneously threaded. The point end threading die opens at the completion of the operation. The head threading die opens when the opening trigger strikes the previously turned surface of the button head of the blank.

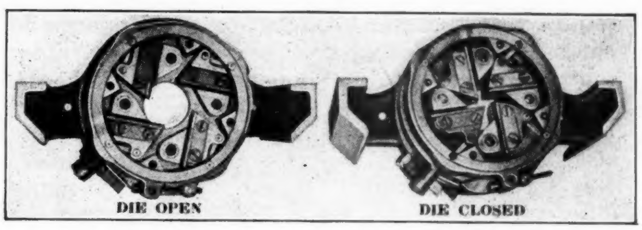


Fig. 14—Self-opening die heads arranged for threading staybolts

Like operations of turning and threading are going

on in the remaining stations. The purpose of four turning and only two threading stations is to keep all stations in actual operation, it having been found that the turning time is about twice the threading time. Owing to the rapidity of the turning and threading operations, two men are at times employed on the one machine. They are kept busy applying and removing the bolts, gaging the threads, etc.

When it is desired that the threads on the point and head ends shall be in perfect pitch with each other, the two die heads are secured to two spacing bars, which hold the pitch of the two threads in perfect alinement.

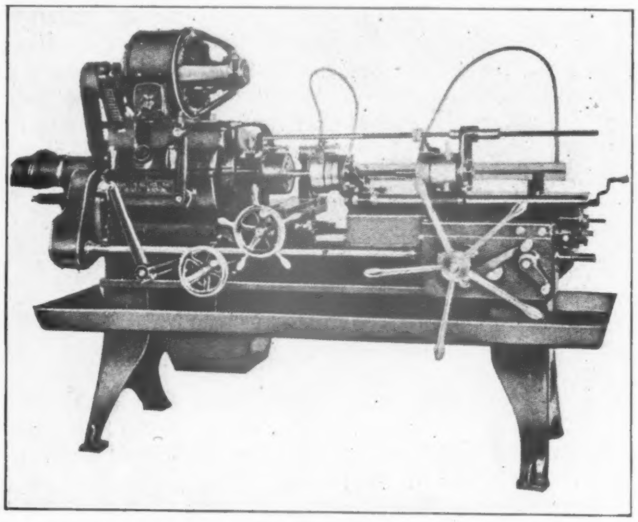


Fig. 15—A Gisholt crown staybolt turning and threading machine

Several shops make a practice of threading the point end of crown staybolts approximately .004 in. smaller than the head end. This is readily accomplished by the setting of the two die heads. Where a taper thread is called for at the head end, a taper threading die head is used.

For the smaller shops, the machines are at times modified by providing two turning stations and one threading station for crown bolts and three stations for the shorter radial staybolts.

Manufacturing on horizontal special purpose machines

Special purpose horizontal machines have been developed for the machining of crown bolts. One form is shown in Fig. 15, which may be considered as representative of a class. This machine, as far as the headstock, the tool holding slide, the cross slide, feeds and control are concerned, is similar to a turret lathe. However, the customary turret is replaced by two sockets for holding internal cutting heads, or self-opening die heads. The front socket is fixed to the slide; the rear socket is adjustable on the slide to accommodate different lengths of bolts. The internal cutter heads are adjustable for different diameters of bolts. Both the cutter head and die heads have sufficient range of openings to pass the unfinished forging while in the open position. The opening and closing of the die heads are controlled by cams located on an adjusting rod, or by hand.

For threading bolts having taper threads at the head end, a special self-opening die head is used, the opening of which is controlled by a cam which causes the dies to open gradually at a rate agreeing with the taper of the thread. When the thread is completed, the chasers open quickly, similar to the regular self-opening die head.

If it is desired that the threads on the two ends of the bolt should be in pitch relative to each other, the two die heads are set to the required distance by a master screw. Some designs of machines are equipped with fine thread adjusting screws for this purpose. A lead screw often forms a part of the machine for moving the slide which insures the correct pitch of the threads. However, when the two die heads are set to a perfect pitch, this hardly appears necessary.

The bolts are held by the square ends in a collet chunk which is opened and closed by a hand-operated lever. The head end is turned either by a single forming tool or a roughing tool in the rear and a finishing tool in the front post of the cross-slide.

In some instances, the point and head ends of the bolts are first turned in one operation, and threaded by a second operation. Another practice is to thread the point end direct from the forging. The head end is formed to the desired size and shape by the cross-slide tools, after which the head end is threaded. This practice requires only one handling of the bolts.

Machining operations

Where it is the practice to turn the two end enlargements of the blank previous to threading, the blank is tightened in the chuck, the two turning heads are quickly moved by hand feed to about ⅛ in. from the surface to be turned, the cutter heads are closed, and the power feed engaged, turning the point and head ends at the same time. The feed is automatically disengaged at the right moment by the throw-out device.

The above practices may be modified by only turning the point end in the first operation, the head end being turned during the threading operation. However, as the point end is the longer operation, both ends may be turned in the same time. Therefore, it is under most conditions advisable to turn the point end to the thread size and the head end about 1/16 in. large to allow for the final finishing. After the turning operations, the blanks are removed and piled awaiting the threading operation.

Turning the blanks as above described, admits of a greater latitude when forging and generally results in a more perfect bolt. However, the turning operation is not considered as absolutely essential in shops making a practice of forging the point and head ends to close alinement with the bar stock.

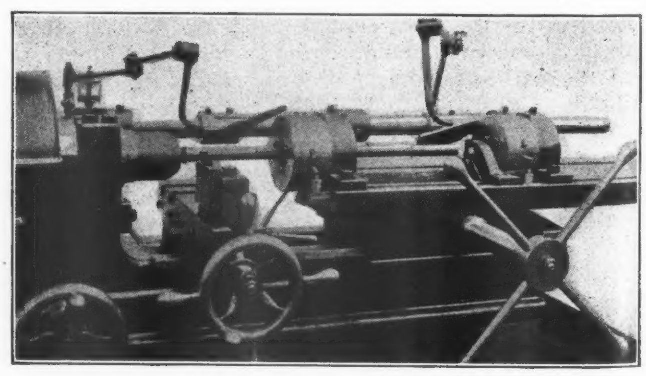


Fig. 16—A type of machine admitting of modifications for the turning of the central section of crown staybolts

Mention has been previously made of crown staybolts made from bar stock of a diameter the full size of the threads. The middle section between the two ends is

turned to a size slightly smaller than the root of the thread. This practice does not appear to be general. However, where properly carried out, this practice should result in a superior grade of bolt. The relative costs compare as follows: The smaller bar stock takes two forging operations, the larger only one. With the smaller stock, it is desirable to turn the point end owing to the difficulty of forging to the correct size for the thread. With the larger stock turning the point end is not essential. With the smaller stock, turning of the middle section is not necessary, however, it is necessary with the larger stock. A greater weight of stock is required for bolts made from the larger stock. Bolts made from the larger bar stock have the advantage that with ordinary care, the threads are perfectly concentric with the reduced section.

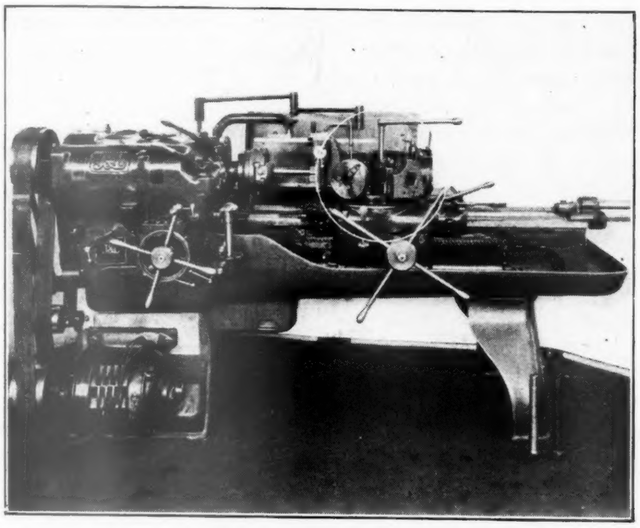


Fig. 17—The circle shows how a bar turner may be modified for turning crown staybolts

The writer has never had an opportunity to observe the actual manufacture of crown staybolts by this method, therefore, the description is largely based on similar machine operations.

The purpose of making crown bolts by reducing the central section in place of enlarging the point end is apparently to obtain a superior product and eliminate the one forging operation of enlarging the point end. The head end must, from necessity, be upset in a forging machine, at which time it would appear advisable to enlarge the stock next to the head to admit of turning previous to threading to insure a full thread in the event of the blank not running true in the machine.

Special machines for the reducing turning operation have not come to the writer's attention. However, the machine shown in Fig. 16 may be modified for this purpose by substituting two-bar turners as shown in the circle portion of Fig. 17, in place of the two die heads. The rear bar turner has backers, or rests in front of the cutting tool. These backers rest on the unturned bar stock. In operation, this bar turner would be located so that the cutting tool may be fed into the bar at the inner end of the point end thread. After feeding into the bar to the required depth, the slide feeds about 1½ in., turning a neck of the desired size for the middle section of the bolt. The front bar turner has backers or rests in the rear of the cutting tool. These are located over the previously necked surface, and the backers and cutting tool are closed to turn to the same diameter as in the previous turning. The power feed is engaged and the blank turned to the head end thread. This method should result in a true turned section, even if the blank is irregular. As the squared end is held in a collect chuck, the blank should run true at the time of the second chucking for threading.

Finished crown bolts piled in steel shelving

When turning on the good grade of iron or steel common for staybolts, the cutting speed can readily approach 75 ft. per min., equalling for 1-in. material, 287 r.p.m. The feed can be about 1/16 in. per revolution, equalling approximately an 18-in. feed per min. For a bolt 24 in. between the point and head end threads, the actual turning time is approximately 1 min. 20 sec. Or when allowing for the handling and changing from the back to the front bar turners, the production per machine should average from 20 to 25 per hour. During this turning operation, the head end can be rough turned by a tool in the cross-slide. The threading of the two ends would be similar to bolts made from the smaller stock. This practice of turning and threading should result in a superior bolt at a cost but little in excess of the most rapid method of manufacture. Owing to the desirability of this method of manufacture, it is worthy of careful consideration.

Feed valve cleaning device

By Ray Brown

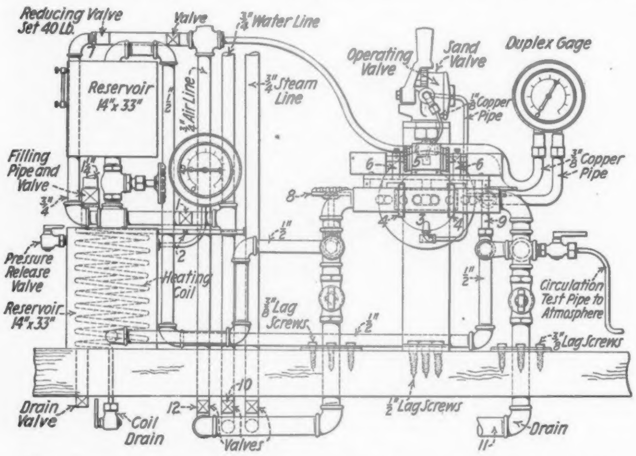
Apprentice instructor, A. T. & S. F., Pueblo, Cal.

FEED valves, after extensive service, often refuse to function properly owing to the parts becoming gummed with oil and dirt. If the valves are cleaned properly they will pass over the test rack without any additional repairs. The object of the cleaning device shown in the illustrations is to wash out the feed valves with a solution of hot lye water without dismantling the valves.

The essential parts of the device consist of two reservoirs, a clamping device, two air cylinders and a series of cut-off and drain valves. The two reservoirs, 33 in. long by 14 in. in diameter, are located one above the other. The lye water for cleaning purposes is stored in the lower reservoir. It contains a coil which is used to heat the water to the desired temperature. The small air gage connected to the reservoir indicates the air pressure to which the reducing valve is adjusted. The upper reservoir is used as a trap to restore the lye water from

the lower tank after passing through the feed valve.

Six pipe connections are made to these reservoirs. Valves for cutting out parts, when necessary, are placed in the pipe lines. Valve (1) is placed in the water connection and is used to refill the reservoir. The opening of the steam connection valve (2) admits steam through the heating coil. A drain valve is placed at the lower end of the heating coil to allow condensation to discharge to the atmosphere. The valves (7), (8) and (9) are the air connections from the reducing valve to the lower reservoir, the lye discharge connection from the lower



The general arrangement of a device for cleaning feed valves

reservoir to the feed valve and the lye discharge connection from the feed valve to the upper reservoir.

Cylinder (3) contains a piston which is made air-tight by a packing leather clamped to the piston follower plate and held in contact with the cylinder wall by an expander. A spring is provided to return the piston back to the release position after the air has been exhausted from the cylinder.

The feed valve clamping arms (4-4) are of the clevis design with open ends connecting to the operating lever. The piston rod of the cylinder (3) is also connected to

Three ingenious improvements add to the life and adaptability of this welding machine

the lever and arms to move in the same direction.

The small cylinder (5) which is directly above the cylinder (3) is supported by a bracket located just above the pipe bracket. This cylinder contains two each of the following operating parts: Pistons, leathers, follower's plates and release springs. The two arms (6-6) shown at each end of the cylinder (5) are connected by pins to the two piston rods. These arms which project down, connect with the top part of the feed valve clamping arms (4-4).

The feed valve clamping arms (4-4) are moved to the open position by placing the operating valve handle in the front position on the quadrant. This position registers port *A* in the valve, allowing the air to flow from the operating valve to the cylinder (5) into the chamber *B* located between the two pistons in cylinder (5), thus moving the pistons outward and compressing the release springs. This movement causes the feed valve clamping arms (4-4) to move in the same direction (open position) by their connection with the piston rods of cylinder (5).

When the operating valve handle is placed in the center position on the quadrant, the port *A* closes, making a direct opening from the chamber *B* to the atmosphere. As soon as the pressure in chamber *B* is reduced sufficiently, the release springs will expand, moving the pistons and clamping arms to the closed position. Moving the operating valve into the chamber *D*, in cylinder (3) forcing back the piston, compressing the release spring and causing the feed valve clamping arms (4-4) to move to the same direction with the piston rod. This movement clamps the feed valve to the bracket in position for cleaning.

To clean the valve, first open the valves (7), (8) and (9). Valve (7) admits air pressure to the reducing valve, shown at the top of the left side of the illustration, which is set at 40 lb. Valve (8) admits the lye water to be forced from the reservoir by the air pressure into the feed valve. After the lye water has passed through the feed valve, the valve (9) allows the water to flow to the upper reservoir where it is stored for further use. After the valve has been cleaned, the valves (8 and 9) are closed and valve (10) and drain valve (11) are opened. Valve (10) admits water pressure which rinses out the feed valve.

After the feed valve has been rinsed sufficiently, valve (10) is closed and valve (12) opened, which admits air pressure to flow through the feed valve to the atmosphere, carrying with it any moisture that may have remained in the feed valve.

PORTABLE ELECTRIC TOOLS.—Portable electrical drills, grinders and buffers are illustrated in catalogue No. 22 issued by the Cincinnati Electrical Tool Company, Cincinnati, Ohio.

SPOT WELDERS.—The Type SG spot welder is described in Bulletin No. 58 issued by the Gibb Welding Machines Company, Bay City, Mich.

MACHINE TOOLS.—The J. G. Blount Company, Everett, Mass., describes in catalogue No. 23 its complete line of belt and motor driven grinders, lathes and polishing machinery.

CUTTING TOOLS.—Catalogue F. of the National Tool Company, Cleveland, Ohio, lists gear and milling cutters, hobs, gear shaper cutters and special tools.

THE RAILWAY AND LOCOMOTIVE Historical Society, which has recently issued Bulletin No. 15, from its new headquarters at the Baker Library, Harvard Business School, Boston, Mass., announces that the Society's room at that location is now completed, and is open for visitors. The room is already decorated with 200 framed pictures of historic locomotives and other early railroad data, and all railroad men and others interested in these things are invited to visit the room. The principal article in the present bulletin is one by Charles E. Fisher, president of the Society, on locomotive building at Taunton, Mass.; with a portrait of William Mason, one of the great locomotive designers of America. For fifty years Mason and his neighbor, The Taunton Locomotive Works, were leading builders, the two concerns supplying engines to prominent roads all over the country.

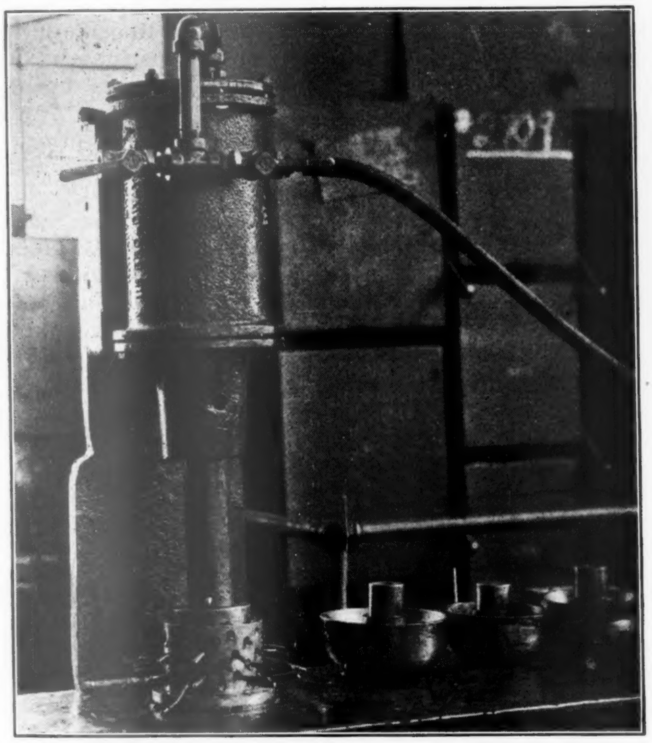
Filling the grease holes of floating bushings

By J. G. Atkin

Road foreman, M-K-T, Bellmead shops, Waco, Texas

THE circumference of a floating bushing contains a series of small holes through which the hard grease feeds for lubrication. Before applying the bushing, these holes must be filled with grease in order to provide an initial lubricant when the locomotive first gets into service. The work is usually done by hand, which requires from 15 to 20 min. per bushing. With the device shown in the illustration the holes can be filled with grease in from 5 to 10 sec., depending on the size of the bushing.

The principal part of the machine is an 8-in. air cylinder with a 12-in. piston travel. This cylinder is attached to a steel plate, 1½ in. thick, 8 in. wide and 5 ft. long. This support may either be attached to the back of a work bench or on the wall, wherever it will be most convenient.



This machine will fill the grease holes in floating bushings in from 5 to 10 seconds

The mandrels are made of soft steel and counterbored for lightness. They are from ¼ in. to ⅜ in. smaller than the bushings and with sufficent taper to form a ball shaped bottom, which forces the grease through the holes in the bushings. The mandrels are fastened to the end of the piston rod. Two cut-out cocks are provided for the control and release of the air. The use of a little machine oil on the mandrels and inside of the floating bushing will prevent the grease from adhering to the mandrel.

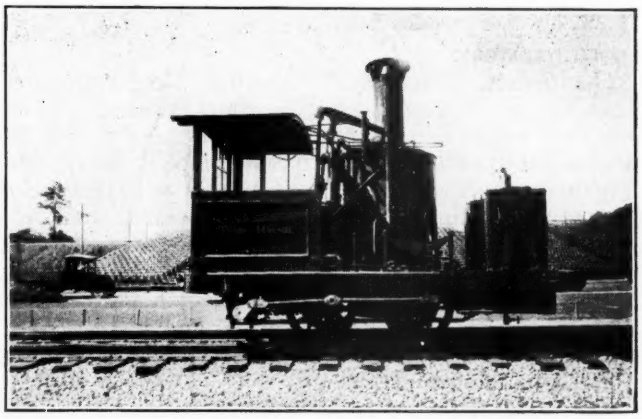
A good one for the blacksmith

THE Denver shops of the Denver & Salt Lake are not large, but the foremen and men are proud of the clean and orderly condition in which the shops are kept There is no dirt and scrap lying around for men to fall over and be injured.

As part of the clean-up policy, the blacksmith foreman had tool racks made and distributed at advantageous points about the blacksmith shop. The racks are made of two 1-in. by 6-in. steel bars, 6 ft. high and 6 ft. apart with a rectangular-shaped bar 18 in. between sides forming the top member. Welded onto the outside of this bar at intervals of 6 in., are hooks 3 in. long on which are hung the blacksmith's tools. About 12 in. below the upper bar is a smaller bar with the same arrangement except that the hooks are spaced alternately with those above so that the blacksmith may reach between the tools which are suspended from the top rack.

A cleverly arranged rack for holding the blacksmith's tools

The upright bars of the rack are fixed firmly in the floor to support the great weight of the tools. By this method the right tool for a certain job is quickly obtainable instead of the blacksmith having to look through a pile of tools on the floor.



The "Thomas Jefferson"—1836—Exhibited at the Baltimore & Ohio's centenary exhibition and pageant, September 24 to October 12, 1927

The Reader's Page

Have You a Question? Ask it
Have You an Opinion? Express it

Testing air brakes—A question

To THE EDITOR:

You have a freight train consisting of 80 cars. The ground test of the air brakes checks O. K. No leaks are found in the train line. A locomotive equipped with a cross compound compressor is coupled to the train but the engineman cannot get the required pressure. The brakes keep applying and releasing. Finally, the pressure automatically adjusts itself to 70 lb. What is the trouble?

W. A. BURNHAM

Who pays for removing condemned car wheels?

McKEES ROCKS, PA.

To THE EDITOR:

The A. R. A. book of interchange rules, effective January 1, 1928, contains on page 111, Rule 98, under which is interpretation No. 6 reading as follows:

"Where the car owner removes a scrap axle on authority of a defect card, the charge shall be confined to the difference in value between the new or second-hand axle applied and the scrap axle removed, including wheels condemned by the remount gage, per Rule 82, except where the mate wheel is condemned on account of owner's defect, in which case the owner shall assume the expense of renewal of both wheels. Rule 65 also applies."

Does the above statement which reads "The owner shall assume the expense of renewal of both wheels" mean that the owner shall not charge for labor and does the above also mean that against the axle shall be charged journal bearings, box bolts and dust guards?

WILLIAM S. ELDER

Now do we all agree?

OMAHA, NEB.,

To THE EDITOR:

The article, Mechanical Drawing and Apprentice Training, by Warren Ichler, in your January number was very astonishing. The fact that the teaching of mechanical drawing as such, has no place in an apprentice training course, seems so self evident as to be beyond the necessity for discussion. Is it possible that apprentice instructors have become confused as to the purpose of the use of drawing instruments and the understanding of geometrical and projection problems in connection with apprentice training, and have drifted away from the real purpose of this work into an attempt to teach mechanical drawing?

The fundamental purpose of apprentice training is to make craftsmen, not draftsmen. An analysis of the requirements of apprentice training develops the fact that apprentices should be taught how to read a shop blueprint, how to make shop sketches, and to lay out their work, on one side; on the other side, they should be taught such simple figuring as is required to solve shop problems. Following which, they should be thoroughly instructed in the technic of the particular craft they are learning.

Apprentices can be taught to read all ordinary shop blueprints by direct instruction. Following their training in the reading of shop blueprints they can then be taught how to read shop sketches, and how to make such sketches. There is no need for drawing instruments or any instruction in the use of such instruments during this period of their training.

Every mechanic should know how to lay out his work. Every graduate apprentice should have sufficient training so that he can do any layout work required in his craft. This is fundamental in such trades as boiler making, and sheet metal work; but a blacksmith may be called upon for dies and forms which require layout knowledge. An upholsterer has to cut patterns for his material. A mechanic must know how to lay out shoes and wedges. In fact, every trade requires a knowledge of layout work if the craftsman is to be considered a master of his trade.

One method, and perhaps the most practical one, of teaching an apprentice the principles of laying out work, is to furnish him with a set of drawing instruments and teach him the principles of geometrical drawing and projection drawing. His projection drawing training includes the study of sections, intersections, and the development of surfaces. These fundamentals mastered, the apprentice can solve any theoretical layout problem presented to him. His practical shop training teaches him the allowances, tolerances, etc., required to make practical layouts. If an apprentice can lay out a problem on his drawing board quickly and accurately, this training combined with his shop experience should allow him to lay out a similar problem quickly and accurately on a boiler plate, or a piece of sheet metal, or cloth, or any other material which he must work with.

It is a fact that the use of drawing instruments gives training in hand and eye coordination that is well worth while to a mechanic, but this is simply a by-product of the layout training. It is also true that the layout training may develop latent drafting ability in particular boys, but this also is a by-product.

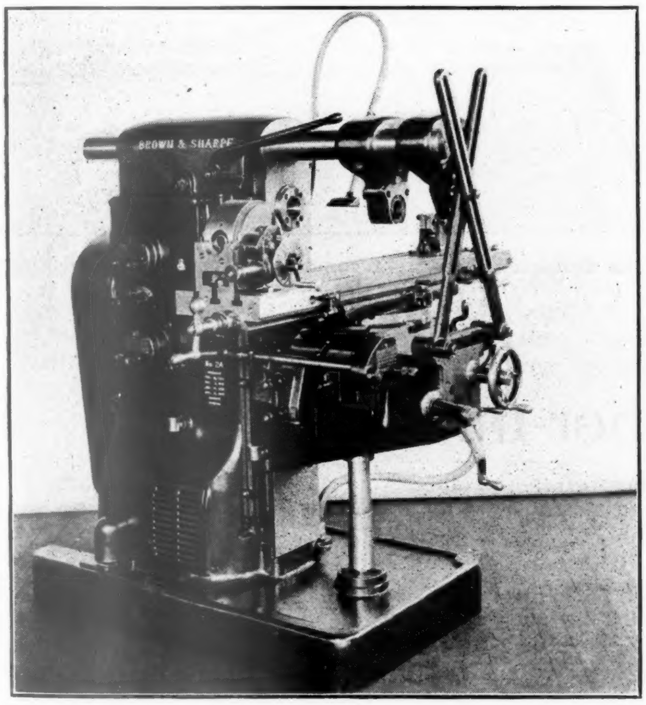
The desirable end to be accomplished is to teach apprentices how to lay out work. This is the fundamental that should be kept in mind in working out teaching methods to accomplish the proper purposes. It so happens that many of the fundamentals which must be taught apprentices to enable them to do layout work properly, are fundamentals of mechanical drawing. It may be that this fact accounts for some apprentice instructors getting off the track and into the teaching of mechanical drawing as an end rather than a by-product of their instruction service.

D. C. BUELL,
Director, Railway Educational Bureau

Milling machines with dual feed control

A NEW line of milling machines with features that simplify control and facilitate operation has been brought out by the Brown & Sharpe Manufacturing Company, Providence, R. I. The line is designated as the Standard and includes Nos. 2-A and 3-A universal and Nos. 2-B and 3-B plain machines.

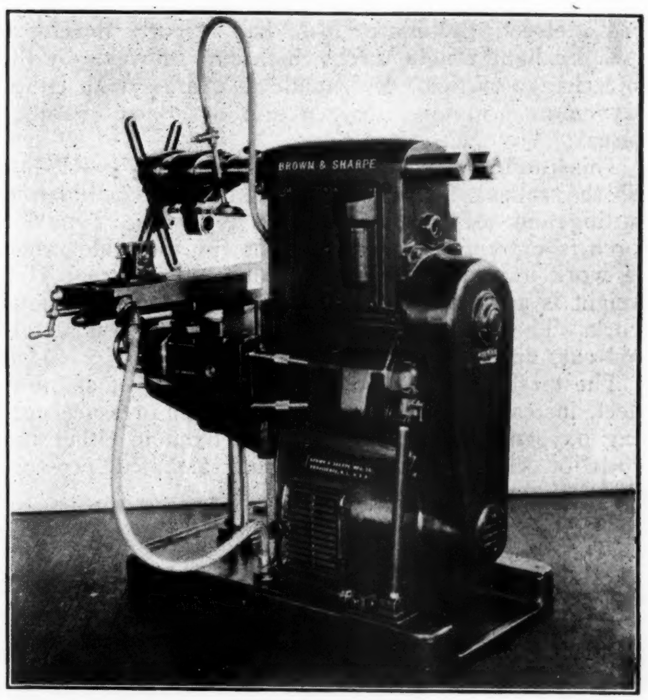
Features intended to facilitate operation include a single lever for speed changes (in two series) ; and a



The feed changes are made by rotating the lever at the front or at the rear of the table

single lever for speed changes (in two series), and a positions, front and rear of the table. Direct reading dials indicate the rate of feed and speed engaged. Power fast travel is provided in all directions, this being gear driven through a safety clutch. Directional feed engagement levers for all feeds are provided at the front and rear of the table. The knee is arranged for clamping from the front or rear of the table.

The dual feed control permits the operator to make feed changes from either the front of the machine in



Rear view of Brown 6 Sharpe No. 2A Miller designed to simplify control and facilitate operation

the normal operating position, or at the rear of the table, for face milling, boring, etc. Changes are made by the simple rotation of a single lever, and the feed in use is shown on a direct reading dial directly above either control lever. Only the feed in use is shown, which is a convenience not only for the operator, but also for the foreman, who can see at a glance if suitable feeds are being used for the work in process. All controlling levers are always thrown in the direction of the movement of the table, which further simplifies the operation of the machines.

One revolution in either direction of a single lever on the left side of the machine gives a change of spindle speed. A direct reading dial above the lever indi-

cates the speed for which the machine is set. Two series of speeds are available, the change from one to the other being made by shifting the back gear lever. Spindle reverse is controlled by a small handle just below the speed change lever.

Oiling of the machine is by a simplified system. All units in the column and driving clutch are automatically supplied with filtered oil, and a gage is provided to indicate whether the pump is working. The inside of the column is coated with a special enamel to prevent grit in the casting from getting into the lubricating system, while the complete inclosure of the column mechanism prevents the entrance of foreign matter. The knee mechanisms are lubricated by a pump which automatically forces oil to all moving parts. The entire saddle mechanism and table bearings are oiled from a single well conspicuously placed at the front.

The cutter coolant system is designed to provide either a flood supply or a thin stream. In either case, it is delivered at low pressure and the pump arrangement is simple and requires little attention. The pump is always immersed and stops when the spindle stops.

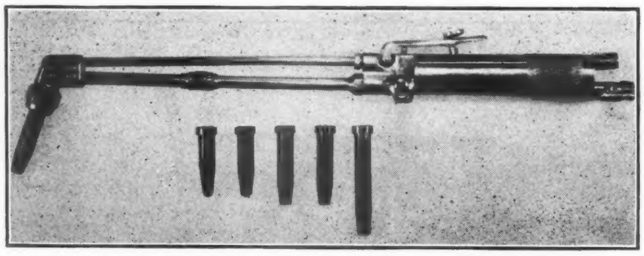
The machines are of rugged construction, and all assemblies are of unit construction. They are equipped with a double overarm and the standardized spindle end and are adapted for motor drive. Sliding gear feed and speed transmissions, an all-gear drive, with heat treated alloy steel gears, and anti-friction bearings from the driving pulley to the spindle, as well as in the feed and power fast travel mechanisms, are other features. The spindle runs in phosphor bronze bearings. Power is transmitted through a dry type multiple disc clutch, which is self-compensating for wear. The elevating screw is of one-piece construction, completely inclosed, which is said to provide unusual accuracy in vertical adjustments.

Combination cutting and welding torch

THE Alexander Milburn Company, 1428 West street, Baltimore, Md., has recently developed a light weight torch which cuts or welds by the interchange of tips. It is made to operate with either oxygen or acetylene, oxygen and hydrogen or other gases.

This torch, designated as the Milburn Type RI, has all the salient features of the Milburn combination cutting and welding torch, Type NI. The Type RI torch is extremely light in weight for the wide range of work it performs, weighing only 40 ounces. This weight is advantageous to the operator for continuous work. The torch welds the lightest or heaviest metals and cuts up to 12 in. in thickness.

The torch has only two gas tubes, made of stainless steel, instead of three tubes. The high pressure cutting oxygen thumb button remains fixed in either the open or closed position without sustained pressure from the thumb. The forged bronze torch head and valves have a tensile strength of 60,000 lb. per sq. in. All of the valves are readily accessible. The super-mixing of gases results in a neutral, uniform flame as well as in the elimination of flashbacks.



The Milburn light weight combination cutting and welding torch

Oliver tilting arbor miter saw

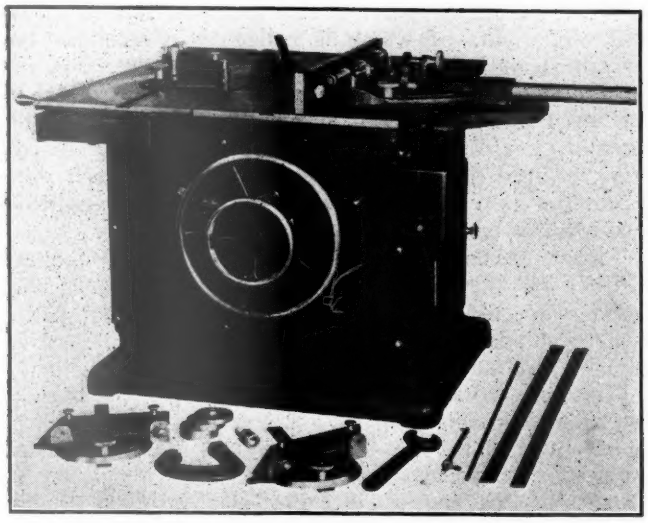
SINCE the advent of built-in motor drives wherein the motor is built directly on the saw arbor, there has been a demand for a circular sawing machine in which the working top of the machine will remain horizontal, but the saw arbor will tilt to any desired angle up to 45 deg. to enable the operator either to rip, cross cut, miter, or dado, at any angle as well as at the square, while the work remains perfectly flat on the horizontal table. The tilting arbor miter saw, shown in the illustration, has been produced by the Oliver Machinery Company, Grand Rapids, Mich., to meet this demand.

The machine will operate saws up to 18 in. in diameter. An 18-in. saw will project through the table 4¾ in. The standard machine will rip work up to 30 in. in width and do any practicable miter or dado work, either in the square or in the angular position up to 45 deg.

The one piece cored casting base measures 33 in. by 39 in. at the floor line, with a built-in dust chute terminating in a 6-in. round hole for easy connection to the blower system. A hinged door at the rear of the base gives convenient access to all working parts of the machine, without the necessity of removing the table.

Either a plain table, or a universal table with a rolling section, can be furnished. The plain table is 4 in. long and 40 in. wide in the main portion, with an 18-in. extension arranged so that it can be mounted either on the right or the left side of the table, giving a total of 58 in. of table width. The extension plate extends to the front edge of the table, providing a substantial increase of the working top of the machine. A graduated scale on the top indicates any width of ripping up to 30 in. The plain table has a metal removable throat piece which can be replaced with a wooden throat piece for dado work. The table is machined on all four edges, affording convenience in mounting forms, jigs, or extensions. Accurate longitudinal slots on either side of the saw are provided for the universal miter gages. The two slideways are 1½ in. wide, 3-16 in. deep, 44 in. long with steel fill-in strips provided when the universal gages are not used. The saw rolls on ball bearing ways provided with a

vertical adjustment for alinement and wear. The rolling table may be moved 4 in. from the saw, permitting the use of dado saws and special heads. The rolling



Oliver No. 88 tilting arbor miter saw equipped with a universal table

table permits doing accurate cross cutting, mitering and grooving up to 36 in. wide.

The motor-on-arbor consists of a 5-hp., 2 or 3-phase, 60-cycle, 220 or 440-volt ball bearing shaftless motor mounted directly on the saw arbor. The tilting of the saw arbor and motor unit is performed by a large hand wheel directly in front of the operator. The angle is indicated by a segment and pointer. Push button operated motor control is furnished and mounted on the front plate of the machine.

The saw arbor is of high carbon ground steel fitted with the rotor of the motor as a unit. It is regularly furnished 1 in. in diameter where the saw is applied, but can be made to suit other desired sizes. A dado sleeve with filling collars enables the saw to carry dados up to 4 in.

At the outer end of the saw dust chamber, a suitable plate with a 6-in. protruding blower pipe connection is provided. This adapter plate can be easily removed, preventing any possibility of the saw dust and chips clogging in case there is no exhaust system.

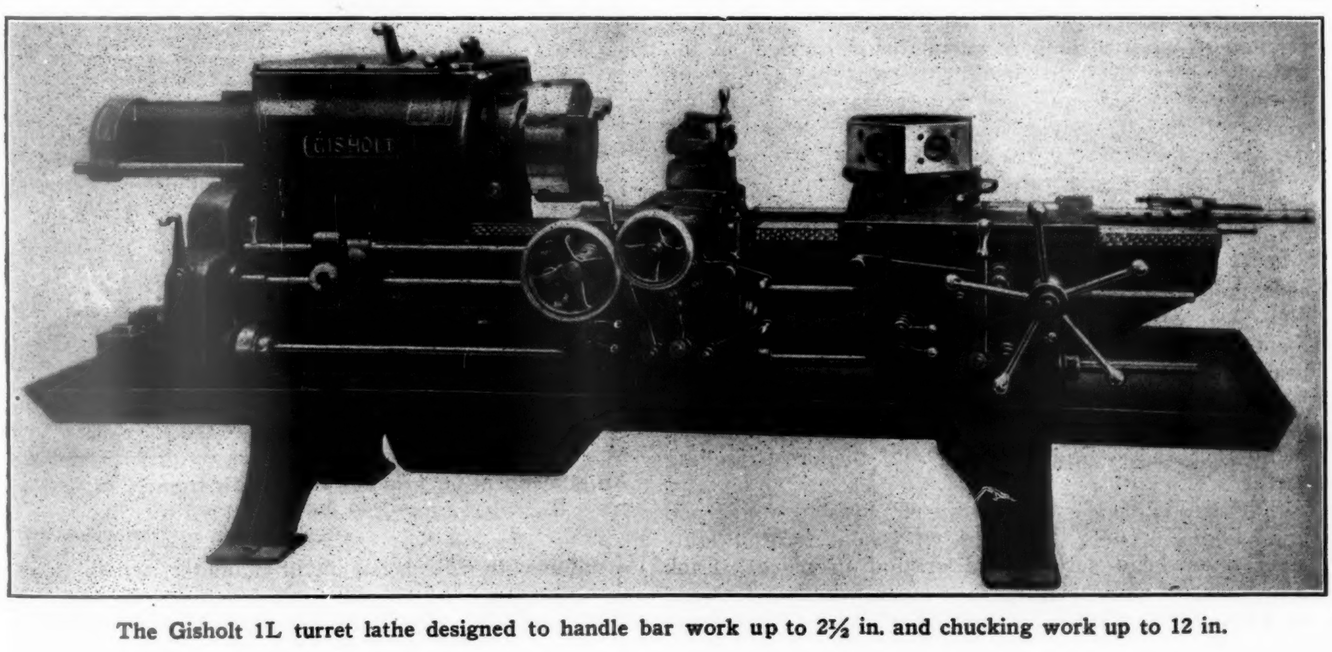
A universal ripping fence may be used on either side of the saw, or secured at any angle not in line with the saw and on either the stationary or sliding table. It has a quick adjustment of 12-in. without changing the locating pins to the next set of holes. A micrometer device is supplied which will adjust the fence to and from the saw for fine and extremely accurate adjustments. It may be tilted to an angle of 45 deg. and it has a parallel adjustment whereby it may be set 9-in. to or from the operator. A metal block is provided for attachment to the fence to serve as a stop and give clearance when cross cutting.

A miter cut-off gage is supplied for use on the sliding table and has a capacity for cutting any angle from 30 to 135 deg. It is used when cutting off very wide stock. It has an auxiliary rod and stop which adjusts in grooves in the face of fence for cutting to various lengths. Two stop rods, one 18 in. and one 36 in. long are supplied.

Turret lathe designed for bar and chuck work

FOLLOWING the announcement made in September of its 2L turret lathe, the Gisholt Machine Company, Madison, Wis., placed on the market a smaller machine of the same general design called the 1L, for bar work up to 2½ in. and chucking work up to 12 in.

The headstock is of rectangular box design with the walls carried well up above the spindle bearings. The center distances of the drive shaft, the intermediate shaft and the spindle are determined by jig bored holes in the solid metal of the walls. The headstock cover is a flat plate carrying only the operating levers. The spindle bearings are of the same adjustable taper design as on other Gisholt turret lathes, except that



The Gisholt 1L turret lathe designed to handle bar work up to 2½ in. and chucking work up to 12 in.

tapered roller bearings have been substituted for anti-friction metal. The headstock drive shaft, intermediate shaft and reverse shaft are also carried on tapered roller bearings.

The single drive pulley runs at 600 r.p.m., affording a high speed initial drive and a wide gear ratio through the hardened steel headstock gearing to the spindle. Twelve spindle speeds ranging from 20 to 486 r.p.m. are provided through sliding gears and the positive jaw clutches mounted on splined shafts. The spindle control lever located just back of the spindle nose convenient to the operator's hand, operates a multiple disc clutch on the drive shaft for starting or reversing the spindle and when placed in neutral, engages a brake which instantly stops the spindles. The multiple disc clutch is made of saw steel and phosphor bronze plates running in oil, but when necessary, can be adjusted without opening the headstock.

From the headstock to the final drive of the carriages all power shafts are mounted on ball bearings. The upper of the two shafts along the front of the bed rotates at the proper speed for feeding the aprons, while the lower shaft rotates at a higher speed for the rapid traverse.

The full universal, full swing, two carriage principle common to the larger Gisholt turret lathes has been employed in the design. A fixed center turret is standard equipment and a cross feeding turret is optional. Eight independent reversible feeds are incorporated in each apron, with another complete range of eight feeds, each slightly coarser, available through a lever at the headstock end.

Longitudinal rapid traverses are provided for both carriages, with automatic stops at the extremes of travel. Rapid traverse is also provided for the in and out movement of the square turret tool post on the cross slide. By virtue of the many ball bearings used, the feed gears in the apron are speeded up for rapid traverse and no separate traverse mechanism at the back of the bed or elsewhere is required, except for the lower drive shaft. This construction permits not only rapid traverse to the side carriage, but also rapid traverse to the cross slide, both of which are desirable on a side carriage turret lathe, especially when used on small work where the operating time is a large percentage of the total floor to floor time.

Engagement of the traverses is made through serrated tooth clutches of hardened steel. A low power friction of non-wearing construction is carried on the traverse drive shaft to cushion the traverse action and to serve as a safety. The two carriages may collide in traversing or be run against a dead stop without danger of breakage.

The square turret on the cross slide automatically indexes one quarter turn as the clamping lever is released. The hollow hexagon turret is of thick section and is clamped to its base by a double bevel steel clamping ring operated by a powerful compound toggle. A tapered index pin seating in hardened bushings locates the turret holes central with the spindle, but the strain of the cut is entirely taken by the bevel clamp ring. Automatic trips are provided for the longitudinal feeds of both carriages and for the cross movement of both the square turret and the cross feeding turret.

The ways of the bed are covered with hardened steel plates securely attached with heat treated alloy steel taper head screws and ground in place. Each movement of the rapid traverse lever, whether forward or back, feeds a small amount of oil by pressure from a plunger in the apron through the under side of the carriage to the ways. Dirt and chips are excluded by the felt and brass wipers, so that the carriages ride on a film of clean oil at all times.

The headstock gearing and clutches run in a bath of oil, a part of which is collected in a splash box, strained and carried to the spindle bearings. The feed train and traverse drive are lubricated with fresh oil from a Madison-Kipp automatic lubricator, so that remote bearings which might otherwise be neglected, are assured of a constant supply of oil. Each apron contains its own oil reservoir from which its gears are constantly lubricated by the splash system.

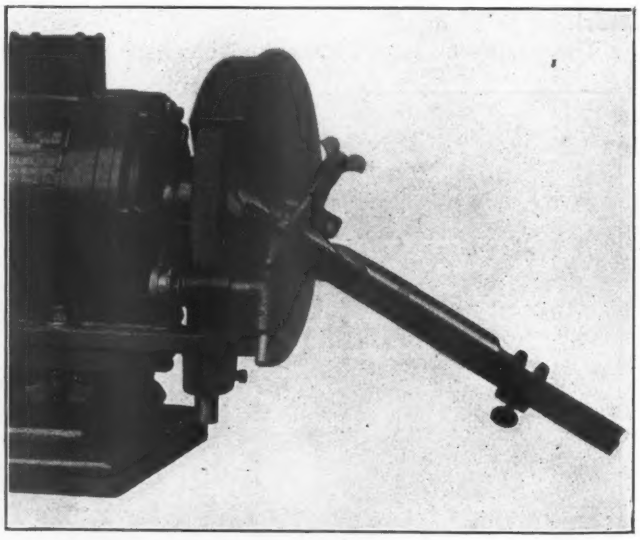
For electric drive, the motor may be mounted either on the headstock or on a special back plate and connected by Allis-Chalmers Texrope, flat belt or silent chain. A 1,200 r.p.m. motor of from 3 to 7½ hp., depending on the work, is recommended.

For bar work, an improved power operated bar feed is provided consisting of a screw driven carrier coupled by a flat cone friction clutch to the headstock power. An automatic chuck with a master collet and size pads is operated by the same lever as the bar feed. A 12-in., three jaw universal chuck is standard equipment for chucking work, but air chucks or wrenchless chucks may be supplied. A taper attachment, leadscrew thread chasing attachment and a complete line of bar and chucking tools are accessory equipment.

The maximum swing is 17 in. over the ways, 14 in. over the side carriage and the maximum distance from the face of the hexagon turret to the end of the spindle nose is 45 in.

Attachment for grinding twist drills

THE illustration shows a twist drill grinding attachment which has been added to the line of The Standard Electrical Tool Company, Cincinnati, Ohio. The device is shown attached to an electric bench grinder with wheels 10 in. in diameter, which gives it the advantage of two distinct machines in one. The attachment is easily interchanged with the regular tool



An attachment for grinding twist drills from ¼ in. to 1¼ in. in diameter

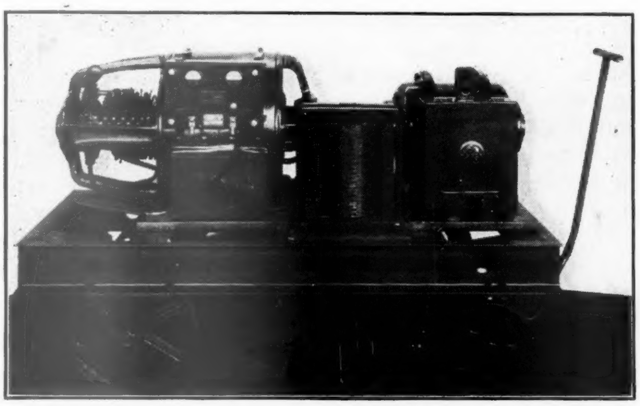
grinding rest and can be quickly mounted in place.

The device greatly facilitates the grinding of twist drills and enables the operator to do the work more rapidly and accurately than by hand. When it is used, gages are not required, as it is equipped with a graduated micrometer screw, the adjustment of which makes the lip lengths identical.

A medium grade grinding wheel of 60 grit should be used, and should be kept well dressed so as to have a straight surface. The attachment is used for grinding either straight or taper shank twist drills ranging in size from ¼ in. to 1¼ in. in diameter and can be furnished for any standard grinder with wheels up to 12 in. in diameter.

A single-operator welder delivers 300 amperes

A SINGLE-OPERATOR welder rated at 300 amp., one hour, 50 deg. C. temperature rise is announced by the General Electric Company, Schenectady, N. Y., as the latest addition to its standard line of welding equipment. This machine includes a four-bearing, ball-bearing, motor-generator set with a flexible coupling.



The field control in the generator of the General Electric WD-300-A arc welder has been eliminated

With this equipment, a rapid and simple interchange of motors may be made by the user. As a result, inspection, maintenance, renewals and changes caused by changes in the supply circuit can be simplified.

The driving motor is a 15-hp., 40-deg. C., continuous-rated unit. This conforms with the recent ruling of the National Electric Manufacturers Association. The generator is so designed that the field control is unnecessary and is eliminated. The generator panel includes an ammeter and a volt-meter, but not the customary field rheostat. The meters used have a metal front except for the glass over the scale, thus minimizing the possibility of breakage.

The motor starters for the 60, 50 and 25-cycle motors are of the enclosed magnetic type, while those for the 25-cycle motors are enclosed resistor starters. The direct-current motors use a simple resistance starter with a line switch. Starting current is maintained in each case well within N.E.L.A. requirements.

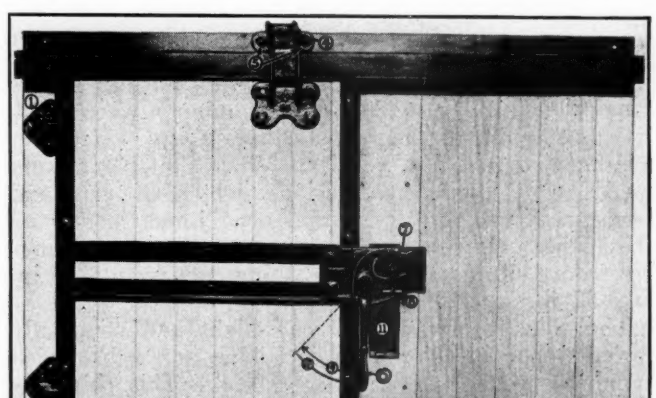
The generator is designed to permit belt, motor or engine drive, and will be designed for either stationary or portable use. It can be used as both a manufacturing and a repair tool, for service in foundries, locomotive and car shops, shipyards, marine repair yards, tank shops, general machine shops and in any other field where iron or steel is used. It bears the General Electric designation WD-300-A.

Stay-Tite car lock

THE Automatic Car Lock Company, Candler Building, Atlanta, Ga. has recently placed on the market a freight car door lock known as the Stay-Tite car lock designed to prevent damage to car doors due to forcing the door open when it has jammed, to prevent distortion of the door in service and to hold the door securely against the door frame when it is closed. These locks may also be utilized to convert vent cars to general merchandise cars by locking the doors in a closed position. On such cars, two Stay-Tite locks are used on each door so that the doors may be locked in either the open or closed position, as desired. The Stay-Tite lock, as illustrated and described here, is separate from an automatic theft proof lock, which may be furnished as extra optional equipment.

The operation of the Stay-Tite lock is as follows: The lever arm, indicated by the number *6*, supplies the motive power for opening or closing the door. This lever arm is attached to what amounts to a circular jacking apparatus. To close the door, lever arm *6* is pulled downward in the direction indicated by arrow *B* until it is in the position shown. The swinging latch *7* drops down and holds the door in the closed position.

To open the door, the lever arm *6* is pulled upward in the direction indicated by arrow *A*, the circular jacking apparatus exerting a powerful leverage which forces the door open. In cases where tonnage is loaded



The operation of the Stay-Tite car door lock is explained by this illustration

against the door, after removal of the tonnage it is claimed that the door will open easily.

Note the came shown in the illustration by the numbers *1, 2, 3* and *4* at top and bottom of the door, take up by friction the force of the door as it is driven shut. The result is that they pull the door tightly against its landing, and check its closing sufficiently to prevent damage being done to the end came, *1* and *2*, which hold the door closed against its landing at that point. The top and bottom cams (*3* and *4*), together with the two braces across the center of the door, prevent the door from bulging and being forced off its tracks. The Stay-Tite car lock is manufactured for both single and double walled cars, the illustration shown being an installation on a double walled car. It is so designed that it is interchangeable for right and left hand sides of the doors, no additional parts being needed to make the change.

Firth Sterling Circle C steel

The Firth Sterling Steel Company, McKeesport, Penna., has recently anounced a new type of high speed steel known as Circle C steel. This steel was developed in an effort to produce a material with a considerably greater cutting capacity than standard high speed steels. Manganese steel has always presented a difficult problem as far as machinability is concerned and certain tests were conducted by the manufacturers of Circle C to determine its action on this material. The following is an abstract of a report of these tests furnished by the Firth Sterling Steel Company:

The test bars used were 3 in. in diameter rolled manganese steel with a content of about 12 per cent manganese, 1.20 per cent carbon. Using a test bar that was supposedly unmachinable, the accustomed "breakdown" process was not attempted. Instead, all effort was directed to prevent tool failure. The test had for its object simply the practical purpose of demonstrating that manganese steel can be machined on a commercial basis. Commercial machining of manganese steel was held to imply that the tool must remove metal at a rate commensurable with the grinding process for at least two hours between grindings of the tool, so that a workman supplied with four such tools could do a day's work with no time lost for regrinding.

The tests were carried on under circumstances that would obtain in almost any ordinary machine shop. The lathe used was a 24-in. back-geared, cone pulley belt driven and gear feed machine in fair condition. The lathe tools were forged from ⅞-in. by 1¼-in. Circle C steel. In form these tools were similar to those used on heavy duty work and in many cutting tests with a front and side clearance of between six and eight degrees, a top back rake or clearance of eight degrees and a top side rake or angle of 14 deg. The nose had a radius of 7/16-in. (half the width of the tool). The cutting edge was on the center line of the work.

During the progress of the tests, cutting speeds ranging from 7½ to 28 feet per minute were tried. It was found that the range from 7½ to 15 feet per minute gave the best results. When suitable cutting speeds were established various depths of cuts and feeds were tried. Within the speed range mentioned above the tools stood up satisfactorily on feeds ranging from 1-60 in. to 1-50 in., taking cuts from 1-16 in. to 5-32 in.

The chip formed was a very tight and compactly curled ribbon in color deep dark blue or the brownish gunmetal peculiar to manganese steel. This chip was oily smooth on the under side and would break only when it became entangled. Five to ten minutes before the tool was ready to be taken out for regrinding, the chip would begin to straighten out into a long wavy ribbon which, under an electric light, would show a dull red color three or four inches coming from the cut.

At no time during the test were the tools allowed to fail completely. At the first sign of failure they were removed and reground to carry on with further tests. When this stage of failure was reached the cutting edge was slightly rounded and at a small spot a concentrated erosion and discoloration were evident.

The great pressure against the cutting edge suggested that the work might push the tool away on fine cuts. To determine this point, the tool was set to take a cut 1-64 in. deep which it would hold accurately and without difficulty across the entire length of the test bar, indicating that manganese steel can be machined to close size limits.

Considerable attention was given to the heat treatment of the tools. While the treatment of Circle C steel does not differ radically in procedure from that of other high speed steels, it does require a definite increase in the heats used. All the tools tried made better records on the second and third grinds than on the first, from which it was deduced that the high qunech-ing heat required had a tendency to lessen the hardness on the surface of the steel.

In general, it was observed that for best results the work must be firmly chucked, the tool well supported with very little overhang and the machine should be rugged. Chattering caused a considerable decrease in the life of the tool. All test were run dry.

Summarizing the results, with tools made of the steel under test, manganese steel can be commercially machined using cutting speeds from 7½ to 15 feet per minute with depths of cuts up to 5-32 in. and feeds of 1-60 in. to 1-50 in. Within the range of combinations of these variables the time of cut between grindings of the tool runs from one to nine hours.

Similar results have been secured in machining manganese steel castings, some of them being scrap castings containing sand inclusions and other defects that put the cutting tool to an exertmely hard test. Further tests now in progress give evidence of equally satisfactory performances on drilling and other machining operations. Such work would include machining billets, car wheels, heat treated steels (including the alloy automobile steels in the heat treated forms), phosphor-bronze gears and other products which require that the tool cut closely to size under severe conditions.

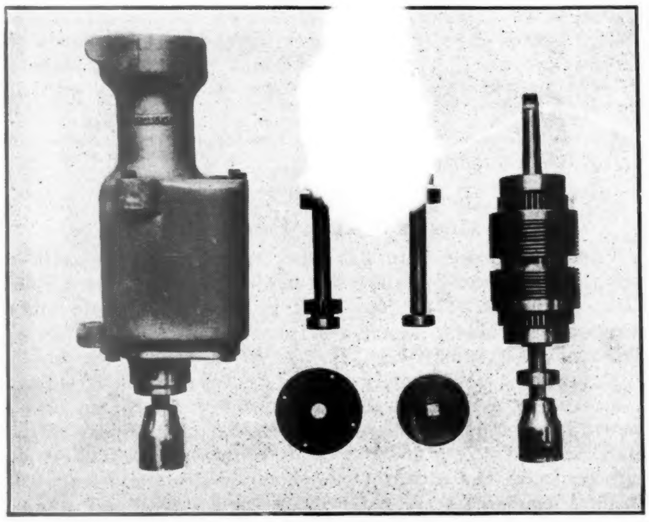
Electric Tools.—Catalogue No. 14 issued by the Black & Decker Manufacturing Company, Towson, Md., contains illustrations and descriptions of portable electric drills and stands, bench and pedestal grinders, twist drill grinders, portable tappers, valve refacers, etc.

Stanley Tools.—Rules, planes, plumbs and levels, squares, gages, etc., comprise the Stanley line of carpenters' and mechanics' tools, for which complete specifications, prices, etc., are given in catalogue No. 34 issued by the Stanley Works, New Britain, Conn.

Friction tapper for high speed drill presses

THE patented friction tapper, illustrated, has been designed for the high speed sensitive drilling machines manufactured by the Fosdick Machine Tool Company, Cincinnati, Ohio, and can be applied to the lower end of the spindle sleeves.

By using this tapping mechanism it is possible to tap to the bottom of holes witho[illegible] danger of tap breakage, consequently the bottom [illegible] the holes can be of various depths. The tap resp[illegible] instantly at whatever



A sectional view of the Fosdick friction tapper

speed the machine is running. The forward and reverse mechanism consists of two sensitive, yet powerful, self-adjusting multiple disc frictions running in oil. Downward pressure on the feed lever drives the tap forward, while the upward pressure reverses the tap for backing out. The adjustable depth stop on the spindle sleeve is especially suited for accurate depth tapping. The tapper automatically releases at the desired depth. Ball bearings are used on all revolving parts.

The tappers are made in three sizes. The smallest size has a capacity of 3-16 in. at 3,000 r.p.m., the next size has a capacity of 5-16 in. at 1,500 r.p.m., and the largest is of ½ in. capacity, at 500 r.p.m.

Cleco pneumatic chipping hammer

THE Cleveland Pneumatic Tool Company, Cleveland, Ohio, has placed on the market a chipping hammer which has included in it a new method of air circulation and control that permits of exceedingly high speed without short stroking or sacrificing any of the power or easy holding qualities of the hammer. The hammer is air balanced and each of its moving parts is so synchronized as to eliminate any vibration or recoil.

The throttle valve is the two-stage type, which graduates the air supply and regulates the force of the blow. The valve is the ball type and has a graduating apron at the front so tapered as to allow the air to pass into the hammer gradually. As the thumb latch is further depressed the movement of the piston is gradually accelerated until the maximum speed and power of blow is reached, thus eliminating all recoil or vibration in action. No air vent port is required in the throttle valve and therefore, no air is lost at this point.

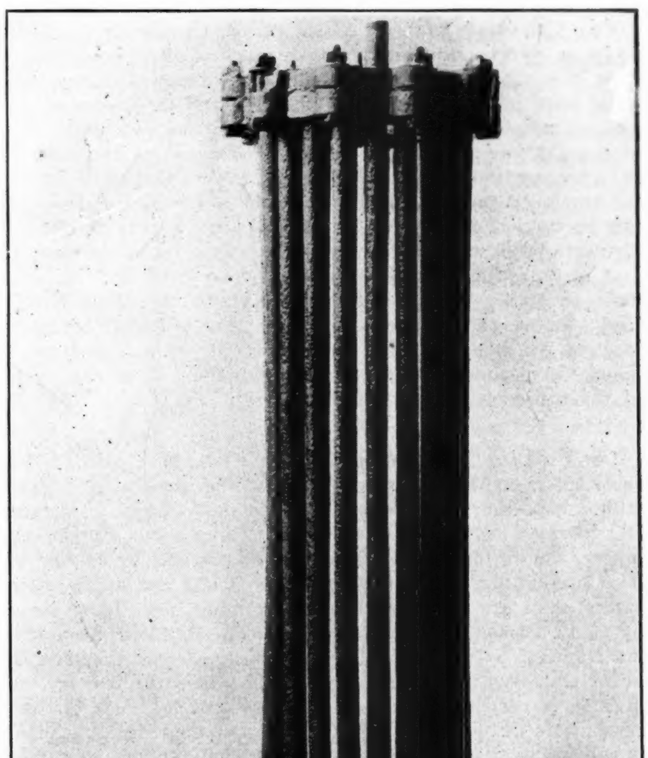
The cylinder at its forward end is reinforced by a tapered retaining wall. The piston is tapered correspondingly which is intended to eliminate cylinder breakage at this point. The piston has an unusually liberal bearing surface which makes for steadiness in action, eliminating any lateral motion to cause undue wear of the cylinder bore.

The main valve is the spool type. It is reinforced at the lower end and has a liberal bearing surface. The valve, valve block and cylinder have liberal bearing surfaces which are hardened, ground and honed to a glass-like finish.

The alloy steel drop-forged handle is made in two types with a clamp bolt lock or ratchet lock, as preferred. Two styles of handdles are furnished—open or enclosed with an outside latch.

FOUR-TONED WHISTLES and handsomely furnished steam-heated cabs, says the Chicago Daily News, are features of giant new locomotives. "Being used to anything, we don't object to the four-toned whistle, but romance flies with the high toned cab. In addition to a time-table, the railroads may have to issue a musical program for their new key-bugle locomotives, of course, subject to change without notice."—Railway Age.

* * * *



Tubes used in the vertical boiler of the John Steven's experimental locomotive built by him in 1825—This relic of the early days of the steam locomotive is preserved in the National Museum, Washington, D. C.

News of the Month

THE ENGINEHOUSE, the master mechanic's office and other buildings of the Baltimore & Ohio at Connellsville, Pa., were destroyed by fire on February 2; estimated loss, including damage to 26 locomotives, $100,000.

APPLICATIONS FOR APPOINTMENTS to research graduate assistantships are now being received by the director of the Engineering Experiment Station, Dean M. S. Ketchum, University of Illinois, Urbana, Ill. These assistantships, for each of which there is an annual stipend of $600 and freedom from all fees except the matriculation and diploma fees, are open to graduates of approved American and foreign universities and technical schools who are prepared to undertake study in engineering physics, or applied chemistry. Appointments to these assistantships must be accepted for two consecutive collegiate years of 10 months each, at the expiration of which period, if all requirements have been met, the degree of Master of Science is conferred.

THE CANADIAN RAILWAY CLUB (C. R. Crook, secretary, 129 Charron street, Montreal) announces that the club offers a prize for the best paper on employee education, competition being open to "all members of the club and employees of any transportation company in Canada holding position under that of general foreman, or chief clerk." Competitors are expected to write on the value of education to the employee and to the employer and in general, how such a scheme of education can be carried out to the best advantage. Papers should not be over 4,000 words in length. The writer's name must be sent in on a slip separate from the paper itself and the essay must be in the hands of the secretary not later than May 1. The winning paper is to be read by the author at a regular meeting of the club. The prize is a course in the International Correspondence School, Scranton, Pa., or, at the option of the recipient, the sum of $45 in cash.

THE CHICAGO GREAT WESTERN, for the first 11 months of 1927, recorded casualties to its employees at the low rate of 4.3 per million man-hours. In the car shops of the Wabash, at Decatur, Ill., 600 men have gone 13 months without having a reportable injury, and during the last three months not a minute's time has been lost on account of any accident. These and other bits of safety news are contained in the December news letter issued by C. F. Larson, secretary of the Steam Railroad Section of the National Safety Council. The Chicago Great Western has never employed a paid safety man; the superintendent on each division is responsible for safety work and he holds his staff responsible in this, as in other features of their duties. Superintendents issue a daily bulletin, by telegraph, giving the number of days since there has been a reportable injury to an employee on the division; and copies of this bulletin are given to trainmen with train orders.

CLASS I RAILROADS in 1927 installed in service 75,386 freight cars, according to reports filed with the Car Service Division of the American Railway Association. This was a decrease of 28,614 freight cars as compared with the number installed in 1926 and a decrease of 53,036 under that for 1925. Of the total box cars numbered 32,210; coal cars 29,060, and refrigerator cars, 6,019 The average carrying capacity per freight car on January 1, 1928, was 45.7 tons, as compared with 43.1 tons on January 1, 1923, or an increase of 6 per cent.

Freight cars on order on January 1 this year totaled 13,057, as compared with 21,242 one year ago.

Locomotives placed in service in 1927 totaled 1,955, a decrease of 444 compared with 1926 but an increase of 222 over 1925. The average tractive power increased 4,982 pounds per locomotives or 13.2 per cent. Class I railroads on January 1, 1928, had 93 locomotives on order, as compared with 329 on January 1, 1927.

These reports as to freight cars and locomotives include new and leased equipment.

Movies of Iron Horse Fair

THE BALTIMORE & OHIO has started a motion picture train on a tour of its system to show pictures of the Centenary Exhibition and Pageant to employees of the company and to others who were not able to attend the Iron Horse Fair at Baltimore. The train has visited Green Spring, W. Va., and Somerset, Pa.

The theatre consists of two cars—a coach was converted into a motion picture theater and a baggage car into an electric generating and heating plant. The seating capacity of the theater car is 80 people and the car is equipped with motion picture projector and screen, Orthophonic Victrola and amplifiers. In the baggage cars are installed a heating system and an electric generator supplying the electricity for lighting purposes and operating the projector and music.

The four-reel set of motion pictures shows the pageant in the sequence in which it was produced at Baltimore from the appearance of the Centenary Band until the finale. The music has been selected from the available phonographic records as nearly as possible to that played by the Centenary Band or sung by the Baltimore & Ohio Glee Club during the passing of the pageant every day of the Centenary Exhibition.

Meetings and Conventions

E. H. WEIGMAN, master car builder of the Kansas City Southern at Pittsburg, Kan., has been appointed secretary-treasurer of the Southwest Master Car Builders' and Supervisors' Association.

Railroad Division A. S. M. E. meeting

THE RAILROAD DIVISION of the American Society of Mechanical Engineers will hold a joint meeting with the Metropolitan Section and the various student branches in the Metropolitan area on March 14 at the Engineering Societies building, 29 West Thirty-ninth street, New York. At this meeting an award will be presented to the student who has written the best technical paper during the past year, and the final report of the Railroad Division, Sub-Committee on Professional Service, on the mechanical engineer in the railroad and railway supply industries will be presented and discussed. A number of well-known mechanical engineers in both industries have been invited to discuss this report. An invitation has also been extended to special apprentices and mechanical department officers to attend this meeting and discuss the report.

The following list gives names of secretaries, dates of next or regular meetings and places of meeting of mechanical associations and railroad clubs.

AIR-BRAKE ASSOCIATION.—T. L. Burton, 165 Broadway, New York. Next meeting May 1-4, Book-Cadillac hotel, Detroit, Mich.

AMERICAN RAILWAY ASSOCIATION DIVISION V.—MECHANICAL.—V. R. Hawthorne, 431 South Dearborn St., Chicago. Next meeting June 20 to 27, 1928, inclusive, Atlantic City, N. J.

DIVISION V.—EQUIPMENT PAINTING SECTION.—V. R. Hawthorne, Chicago. Next meeting Windsor hotel, Montreal, September 11-13.

DIVISION VI.—PURCHASES AND STORES.—W. J. Farrell, 30 Vesey St., New York. Next meeting June 20-22, Atlantic City, N. J.

AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.—G. G. Macina, 11402 Calumet Ave., Chicago. Annual convention Hotel Sherman, Chicago, August 29-31, 1928.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. Thirty-ninth St., New York. Railroad Division, Marion B. Richardson, associate editor, *Railway Mechanical Engineer,* 30 Church St., New York. Next meeting, March 14, the Engineering Societies Building, 29 West 39th Street, New York. Presentation of the final report of the Sub-Committee on Professional Service on the opportunities afforded the mechanical engineer in railroad and railway supply work.

AMERICAN SOCIETY FOR STEEL TREATING.—W. H. Eiseman, 4600 Prospect Ave., Cleveland, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS.—C. L. Warwick, 1315 Spruce St., Philadelphia, Pa. Annual meeting June 25-29, Chalfonte-Haddon hotel, Atlantic City, N. J.

AMERICAN WELDING SOCIETY.—Miss M. M. Kelly, 29 West Thirty-ninth St., New York.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.—Joseph A. Andrucetti, C. & N. W., Room 411, C. & N. W. Station, Chicago, Ill. Annual meeting, October 23-26, Hotel Sherman, Chicago.

CANADIAN RAILWAY CLUB.—C. R. Crook, 129 Charon St., Montreal, Que. Regular meetings, second Tuesday in each month, except June, July and August, at Windsor Hotel, Montreal, Que. Next meeting March 13. Paper on railway law will be presented by Frederick Collins, B.A., B.C.L. advocate.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—Aaron Kline, 626 N. Pine Ave., Chicago, Ill. Regular meeting second Monday in each month, except June, July and August. Great Northern Hotel, Chicago. Next meeting March 12 at 8 p. m. A paper on the proposed changes in A.R.A. Rules will be presented.

CAR FOREMEN'S ASSOCIATION OF ST. LOUIS.—A. J. Walsh, 5874 Plymouth Apt. 18, St. Louis, Mo. Regular meeting first Tuesday in each month, except June, July and August, at Broadview Hotel, East St. Louis, Ill. Next meeting March 6 at 8 p. m. Discussion of 1928 A.R.A. Rules.

CAR FOREMEN'S CLUB OF LOS ANGELES.—J. W. Krause, 514 East Eighth St., Los Angeles, Cal. Meeting second Friday of each month in the Pacific Electric Club building, Los Angeles, Cal.

CENTRAL RAILWAY CLUB.—H. D. Vought, 26 Cortlandt St., New York. Regular meetings second Tuesday each month, except June, July and August, at Hotel Statler, Buffalo.

CHIEF INTERCHANGE CAR INSPECTORS' AND CAR FOREMEN'S ASSOCIATION.—(See Railway Car Department Officers' Association.)

CINCINNATI RAILWAY CLUB.—D. R. Boyd, 3328 Beekman St., Cincinnati. Regular meeting second Tuesday, February, May, September and November.

CLEVELAND RAILWAY CLUB.—F. L. Frericks, 14416 Adler Ave., Cleveland, Ohio. Meetings first Monday each month, except July, August and September, at Hotel Hollenden, East Sixth and Superior Ave., Cleveland. Next meeting March 5. Discussion of A.R.A. Rules of Interchange.

INTERNATIONAL RAILROAD MASTER BLACKSMITHS' ASSOCIATION.—W. J. Mayer, Michigan Central, 2347 Clark Ave., Detroit, Mich. Next meeting Hotel Sherman, Chicago, August 21-23, 1928.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—L. G. Plant, Railway Exchange, 80 E. Jackson Boulevard, Chicago. Next meeting Chicago, May 7-11, 1928.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—William Hall, 1061 W. Wabash Ave., Winona, Minn. Annual convention Hotel Sherman, Chicago, September 4-7, 1928.

LOUISIANA CAR DEPARTMENT ASSOCIATION.—L. Brownlee, 3212 Delachaise street, New Orleans, La. Meetings third Thursday in each month.

MASTER BOILERMAKERS' ASSOCIATION.—Harry D. Vought, 26 Cortlandt St., New York. Annual meeting Cleveland, Ohio, May 22-25.

NEW ENGLAND RAILROAD CLUB.—W. E. Cade, Jr., 683 Atlantic Ave., Boston, Mass. Regular meeting second Tuesday in each month, excepting June, July, August and September, Copley-Plaza Hotel, Boston. Next meeting March 13. Annual meeting; election of officers and reports. Moving pictures from coal to electricity and Conowingo, by A. A. Northrop, Stone & Webster Co.

NEW YORK RAILROAD CLUB.—H. D. Vought, 26 Cortlandt St., New York. Meetings third Friday in each month, except June, July and August, at 29 West Thirty-ninth St., New York.

PACIFIC RAILWAY CLUB.—W. S. Wollner, 64 Pine St., San Francisco, Cal. Regular meetings, second Tuesday of each month in San Francisco and Oakland, Cal., alternately.

RAILWAY CAR DEPARTMENT OFFICERS' ASSOCIATION.—A. S. Sternberg, Belt railway, Clearing Station, Chicago.

RAILWAY CLUB OF GREENVILLE.—Paul A. Minnis, Bessemer & Lake Erie, Greenville, Pa. Meeting last Friday of each month, except June, July and August. Next meeting March 20. Moving pictures and talk on Nicholson thermic-syphon by Mr. Graves of the Locomotive Firebox Company.

RAILWAY CLUB OF PITTSBURGH.—J. D. Conway, 515 Grandview Ave., Pittsburgh, Pa. Regular meeting fourth Thursday in month, except June, July and August. Fort Pitt Hotel, Pittsburgh, Pa.

ST. LOUIS RAILWAY CLUB.—B. W. Frauenthal, M. P. O. Drawer 24, St. Louis, Mo. Regular meetings, second Friday in each month, except June, July and August.

SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.—A. T. Miller, P. O. Box 1205 Atlanta, Ga. Regular meetings third Thursday in January, March, May, July, September and November. Annual meeting third Thursday in November. Ansley Hotel, Atlanta, Ga.

SOUTHWEST MASTER CAR BUILDERS' AND SUPERVISORS' ASSOCIATION.—E. H. Weigman, master car builder, the Kansas City Southern, Pittsburg, Kan. Annual meeting August 4, 5 and 6 at Galveston, Tex.

TEXAS CAR FOREMEN'S ASSOCIATION.—A. I. Parish, 106 West Front St., Fort Worth, Tex. Regular meetings first Tuesday in each month. Terminal Hotel bldg., Fort Worth, Tex. Next meeting March 13.

TRAVELING ENGINEERS' ASSOCIATION.—W. O. Thompson, 1177 East Ninety-eighth St., Cleveland, Ohio. Annual meeting Hotel Sherman, Chicago, October 2 to 5, inclusive.

WESTERN RAILWAY CLUB.—W. J. Dickinson, 189 West Madison St., Chicago. Regular meetings, third Monday in each month, except June, July and August.

Supply Trade Notes

H. M. ARRICK has been appointed development engineer of the American Rolling Mill Company, with headquarters at Chicago. Mr. Arrick formerly was transportation inspector for the general superintendent of transportation of the Pennsylvania at Chicago.

THOMAS HENRY HOPKIRK, eastern sales manager of the American Steel Foundries, New York, died on February 14 at his residence in that city, after an illness of several months duration. Mr. Hopkirk was 58 years old and had been associated with the American Steel Foundries for more than 20 years. Prior to that time he had worked in various capacities for the Erie. Mr. Hopkirk was born in Toronto, Ontario.

E. C. BRANDT, works manager of the Homewood works of the Westinghouse Electric & Manufacturing Company, and F. J. Shiring, superintendent of motor apparatus, have been appointed assistant works managers at the East Pittsburgh works. J. E. Webster, engineer of works, East Pittsburgh, has been appointed chief plant engineer. A. E. Kaiser, assistant manager of the East Pittsburgh works, has been appointed director of production for all works; S. C. Hoey, superintendent of the manufacturing engineering department has been appointed works manager of the Homewood renewal parts works.

GEORGE A. NICOL, JR., general manager of the railroad and government departments of the Johns-Manville Corporation, with headquarters at New York, has been elected a vice-president. Mr. Nicol was born in Providence, R. I., and educated at Mount Pleasant Academy, English High School and Rhode Island School of Design. He served a special apprenticeship at the Rhode Island Locomotive Works and subsequently was a locomotive designer with the American Locomotive Company, going to the Louisville & Nashville, Louisville, Ky., in March, 1904, as locomotive designer, later specializing in car designs. From August, 1905 until January, 1909, he was with the Baltimore & Ohio as designing engineer in the mechanical department at Baltimore, Md. During the latter year he entered the services of the H. W. Johns-Manville Company, now the Johns-Manville Corporation, as railroad representative. In 1912 he was transferred to the executive headquarters at New York as eastern assistant manager of the railroad department and in 1920, promoted to eastern manager of the same department, and in 1924, appointed general manager of the railroad and government departments.

George A. Nicol, Jr.

Standard Stoker Company, Inc., buys assets of Locomotive Stoker Company

ON FEBRUARY 1 the Standard Stoker Company, Inc., New York, purchased and took over the patents of the Locomotive Stoker Company covering stokers and coal pushers. There were included also in the purchase certain assets necessary to operating under the patents, including the inventories of finished materials and goods in process and the assets of the

plant of the Locomotive Stoker Company at Pittsburgh, Pa.

The Standard Stoker Company, Inc., will manufacture at its Pittsburgh plant, and will supply without interruption, the stokers and coal pushers, and the parts for these devices, which have heretofore been manufactured by the Locomotive Stoker Company.

The Erie plant of the Standard Stoker Company, Inc., will continue to supply the stokers and repair parts of the same types as hitherto.

THE STANDARD FORGINGS COMPANY, Chicago, at a recent meeting re-elected officers and directors with the following changes: C. R. Lewis was made executive vice-president in addition to duties of general manager of sales; A. C. Stockton, formerly vice-president and comptroller was elected vice-president, treasurer and secretary in place of L. C. Ryan, formerly treasurer and C. E. Jernberg, formerly secretary; both having resigned to engage in other business.

E. J. FULLER, since 1914 representative in the northwest district for the Hunt-Spiller Manufacturing Corporation, Boston, Mass., has been appointed assistant sales manager; D. F. Hall, who has been serving as roundhouse foreman at Ottumwa, Iowa, since 1922, has been appointed representative of the Hunt-Spiller Manufacturing Corporation in the northwest district.

EDWARD L. RYERSON, chairman of the board of directors of Joseph T. Ryerson & Son, Inc., died at his home in Chicago on January 19. Mr. Ryerson was born in Chicago, on November 24, 1854. He was graduated from Yale University in 1876 and during the same year entered the iron and steel business of his father, Joseph Turner Ryerson. In 1878 he was made a partner and the business became known as Joseph T. Ryerson & Son. In 1883, upon the death of his father, Mr. Ryerson succeeded as head of the business which was founded in 1842. In 1888, when the business was incorporated, he became its first president, continuing in that office for 23 years. In 1911 he retired from the presidency and became chairman of the board of directors. Mr. Ryerson was associated with a number of financial and civic organizations.

Edward L. Ryerson

LEEDS, TOZZER & CO., INC., 75 West Street, New York City, was recently organized and is equipped to design and furnish special purpose machine tools and machinery and to represent manufacturers as sales agents. Edward L. Leeds, president of the new company was recently vice-president and director of Niles-Bement-Pond Company, vice president of Pratt & Whitney Company and formerly assistant general manager and manager in Europe of the Brown Hoisting Machinery Company, Cleveland. Brent A. Tozzer, vice-president of the new company, was until recently New York manager and sales engineer of the Niles Tool Works Company and Pratt & Whitney Company, and formerly sales engineer and European representative of the Lodge & Shipley Machine Tool Company, Cincinnati. Associated with the new company are experienced engineers who have designed and built many special purpose machines and many machines for mass production.

THE O'MALLEY-BEARE VALVE CORPORATION, Chicago has changed its name to the Central Valve Manufacturing Company. It is continuing the manufacture and sale of the valves and parts formerly fabricated by the old corporation. The manufacture of brass engine castings and journal bearings has been discontinued while a new line of valves, designed especially for railroad service is being placed on the market.

A. E. OSTRANDER, assistant vice-president, sales department, of the American Car & Foundry Company has been appointed foreign sales manager of the American Car & Foundry Export Company, with headquarters at New York. Mr. Ostrander began his career in the operating and mechanical departments of the New York, New Haven & Hartford where he served in various capacities for about nine years. He then resigned to design steel freight cars for Cornelius Vanderbilt. When Mr. Vanderbilt gave up this line of work due to illness. Mr. Ostrander became a designer for the Standard Steel Car Company. He entered the employ of the American Car & Foundry Company in 1903, serving successively as estimator and designer, chief estimator, mechanical engineer and chief mechanical engineer until 1915 when he was appointed general mechanical engineer. In 1924 he was transferred to the sales department as assistant vice-president. During the war Mr. Ostrander was a member of the Standard Car Committee of the Railroad Administration and also collaborated with the United States Ordnance Department in the building and designing of railway artillery and equipment. He is a past member of the Executive Committee, Railroad Division, A. S. M. E., and has also served on several other committees of the society.

A. E. Ostrander

T. M. GIRDLER has been elected president of the Jones & Laughlin Steel Corporation, Pittsburgh, Pa.

THE ROLLER-SMITH COMPANY has made a number of changes and additions to its sale organization in New York. H. S. King has been added to the sales force and will operate in the Metropolitan district; Albert Milmow, Latonia building, Charlotte, N. C., has been appointed exclusive agent for North and South Carolina; W. J. Schuhmann, sales engineer in the New York office for a number of years, has been transferred to the company's works at Bethlehem, Pa.

PHILIP E. BLISS, vice-president of the Warner & Swasey Co., Cleveland, Ohio, has been elected president to succeed Frank A. Scott, who has been made chairman of the board.

B. F. FAIRLESS, vice-president and general manager of the Central Alloy Steel Corporation, Massillon, Ohio, has been elected president and general manager to succeed Charles E. Stuart, resigned. He will be succeeded by S. S. French, president of the Berger Manufacturing division of the Central Alloy Steel Corporation, who will also retain that position. Mr. Fairless was born on May 3, 1890 at Pigeon Run, Ohio and was educated at Ohio Northern University, Ada, Ohio and Wooster University, Wooster, Ohio. He entered railway service on the Wheeling & Lake Erie as a transitman at Brewster, Ohio, in 1912 and on May 3, 1914 became associated with the Central Alloy Steel Corporation at Massillon, Ohio.

B. F. Fairless

Trade Publications

Hydraulic Machines. — Hydraulic machinery, particularly adapted for the metal and rubber industries, is described and illustrated in a 52-page catalogue issued by R. D. Wood & Co., Philadelphia, Pa. This machinery includes presses of various types, shears, riveters, etc.

Drill Chucks.—Catalogue and price list No. 25, issued by Jacobs Mfg. Company, Hartford, Conn., contains new and interesting information about the Jacobs three-model standardization of drill chucks.

Electric Tools.—A 52-page catalogue of Van Dorn and Van Norman electric tools, which include electric drills, brushes, cutters, grinders, abrasive wheels, screw and nut tightening tools, etc., has been issued by the Van Dorn Electric Tool Company, Cleveland, Ohio.

Fuzon Arc Welders.—A general description of Fuzon welders, presented in such a way that the information may be used as a basis of judgment in selecting a welder, is given in the four-page illustrated bulletin issued by the Fusion Welding Corporation, 103rd street and Torrence avenue, Chicago.

High Frame Hammers.—The Chambersburg Engineering Company, Chambersburg, Pa., describes in Bulletin 211-B its high frame guided ram hammers suitable for forging large discs and rings, to upset high stems, form arch bars, etc. Long punching with drifts is facilitated with this single frame hammer.

"File Filosophy".—A general description of files, their common applications, and hints and suggestions as to the proper method of using files, are contained in a 48-page brochure entitled "File Filosophy," which has been issued by the Nicholson File Company, Providence, R. I. The contents of this booklet applies to all files alike, whether made by the Nicholson Company or other manufacturers.

Machine Tools.—A pictorial pamphlet and general specifications of equipment adaptable to special manufacturing and contract work has been issued by the Reed-Prentice Company, Worcester, Mass. Portions of the factory are illustrated and the maximum capacities of machine and foundry equipment given. This equipment includes lathes, radial drills, millers, planers and cutters.

Smooth-On Cement—A description of the general characteristics of each kind of Smooth-On, its principal uses and directions for applying, will be found in the twenty-first edition of the handbook issued by the Smooth-On Manufacturing Company, 570 Communipaw avenue, Jersey City, N. J. Illustrations, made from actual photographs or drawings, show some of the many uses for these cements which are made in powder, putty, paste and liquid form.

Senior Class in Mechanical Engineering.—The second booklet for the benefit of the senior and junior classes in mechanical engineering and those wishing to employ college trained men, has been published by The Pennsylvania State College, State College, Pa. It contains a photograph and brief biographical sketch of each student in the senior class in mechanical engineering, also a group photograph, together with the names, of those in the junior class.

Tool Steels.—Bethlehem tool steels are described in a leather bound brochure of 104 pages prepared by the Bethlehem Steel Company, Bethlehem, Pa. Section I of the booklet describes special high speed and finishing tool steels; Section II, carbon tool steels; Section III, rock and mining drill steels; Section IV, alloy tool steels, and Section V, special alloy tool steels. Instructions for working, trade names, standard classification of extras, tables and useful information are given in Sections VI and VII.

Personal Mention

T. Hambley, master mechanic of the Algoma district of the Canadian Pacific at North Bay, Ont., has been promoted to assistant superintendent of motive power of the Western lines, with headquarters at Winnipeg, Man., succeeding A. Sturrock, who has been given an indefinite leave of absence because of illness.

Master Mechanics and Road Foremen

S. L. Landis has been appointed road foreman of engines of the Kansas City, Coffeyville, Conway Springs, Arkansas City and Roper districts of the Missouri Pacific, with headquarters at Osawatomie, Kan., succeeding H. J. Wade.

N. Nissen, road foreman of engines of the Missouri Pacific, formerly at Kansas City, Mo., has been given jurisdiction over the Omaha and Northern Kansas division with headquarters at Falls City, Neb.

Edward G. Bowie, division master mechanic of the London division of the Canadian Pacific at London, Ont., has been promoted to master mechanic of the Algoma district succeeding T. Hambley.

The Jurisdiction of W. A. Curley, master mechanic of the Little Rock division of the Missouri Pacific at McGehee, Ark., has been extended to include the Memphis division, of the Missouri Pacific.

H. Smith, locomotive foreman of the Ontario district of the Canadian Pacific at Toronto, Ont., has been promoted to division master mechanic ot the London division to replace Edward G. Bowie.

H. J. Wade has been appointed road foreman of engines of the Missouri Pacific, with headquarters at Kansas City, Mo., succeeding N. Nissen, who has been promoted with headquarters at Falls City, Neb.

J. C. Harris, general road foreman of motive power and equipment of the Texas and Louisiana lines of the Southern Pacific, at Houston, Tex., has been promoted to master mechanic of the El Paso division, with headquarters at El Paso. Tex., succeeding William Blieck, who has resigned.

F. G. Perkins, division master mechanic on the Algoma district of the Canadian Pacific at Schreiber, Ont., has been transferred in the same capacity to the Brownsville division of the New Brunswick district, with headquarters at Brownsville Junction, Me.

C. K. Steins, assistant engineer of motive power of the Eastern region of the Pennsylvania at Philadelphia, Pa., has been appointed master mechanic of the Indianapolis and St. Louis divisions, with headquarters at Indianapolis, Ind., succeeding O. C. Wright, resigned.

E. H. Roy, general master mechanic of the Seaboard Air Line at Savannah, Ga., has been appointed master mechanic of the Alabama division and that portion of the South Carolina division between Cayce, S. C., and Jacksonville-Baldwin, Fla., excluding Jacksonville and Baldwin, with the same headquarters. Mr. Roy succeeds H. McLendon.

Shop and Enginehouse

Jesse G. Smith, assistant machine shop foreman of the Norfolk & Western, has been promoted to day assistant machine shop foreman, with headquarters at Portsmouth, Ohio, succeeding William Carroll, deceased.

G. T. Wisbey, gang leader of the Norfolk & Western at Portsmouth, Ohio, has been promoted to assistant machine shop foreman, succeeding Jesse G. Smith.

Car Department

L. S. Kurfess has been appointed assistant superintendent of the car department of the Erie, with headquarters at Hornell, N Y.

J. N. McWood, general car foreman of the Canadian National, with headquarters at Ottawa, Ont., has retired. Mr. McWood had been in the employ of the Grand Trunk and Canadian National railways for 52 years. He started in the car department of the Grand Trunk at Montreal in 1874. In 1897 he was promoted to car foreman, with headquarters in London, Ont. He later served as general car foreman at London, and in April, 1912, was appointed general car foreman of the Ottawa division.

J. F. Haynes has been promoted to car foreman of the Panhandle & Santa Fe, with headquarters at Slaton, Tex., succeeding W. E. Johnson.

J. R. Hayden, assistant superintendent of the car department of the Missouri-Kansas-Texas Lines, at Denison, Tex., has been promoted to superintendent of the car department, with headquarters at the same point.

A. J. Litman, car foreman of the Northern Pacific at Staples, Minn., has been promoted to general car foreman, with headquarters at Missoula, Mont., succeeding C. O. Gilman, retired.

W. E. Johnson, car foreman of the Panhandle & Santa Fe at Slaton, Tex., has been promoted to general car foreman of the Atchison, Topeka & Santa Fe, with headquarters at Wellington, Kans.

Purchases and Stores

W. M. Portlock, general storekeeper of the Seaboard Air Line, with headquarters at Portsmouth, Va., has been appointed purchasing agent.

J. C. McLendon, storekeeper of the Atlantic Coast Line at Southover, Ga., has been transferred in the same capacity to Waycross, succeeding N. V. Oldenbuttel.

J. J. Goins, assistant storekeeper of the Atlantic Coast Line at Montgomery, Ala., has been appointed storekeeper with headquarters at Southover, Ga., succeeding J. C. McLendon.

Samuel Porcher, assistant vice-president of the Pennsylvania in charge of purchases, stores and insurance, with headquarters at Philadelphia, Pa., who has retired, was born on December 21, 1857, in South Carolina, and was graduated from the University of Virginia in 1881. He entered the Altoona machine shops of the Pennsylvania as an apprentice on January 27, 1882, and took the full shop course, including the test department. In 1888 he was transferred from Altoona to the office of the superintendent of motive power in Jersey City, and later in the same year was appointed assistant engineer, motive power department, United Railroads of New Jersey division of the Pennsylvania. He remained in that position until 1894, and was then appointed assistant purchasing agent of the Pennsylvania. On July 21, 1913, Mr. Porcher became purchasing agent, and in January 1918, when the President took over the operation of the railroads, Mr. Porcher was called to Washington to assist in organizing a purchasing department. On March 7 of the same year he was appointed a member of the Central Advisory Purchasing Committee, United States Railroad Administration, and on March 15, 1919, assistant director, division of purchases, United States Railroad Administration. On March 1, 1920, when the railroads were returned to their owners, Mr. Porcher was appointed general purchasing agent of the Pennsylvania system. During the coal strike of 1922, Mr. Porcher was again called to Washington in July and served in charge of railroad fuel on the President's Fuel Distribution Committee. On January 1, 1927, Mr. Porcher was appointed assistant vice-president in charge of purchases, stores and insurance.

Samuel Porcher

N. V. Oldenbuttel, storekeeper of the Atlantic Coast Line, at Waycross, Ga., has been appointed assistant general storekeeper, with the same headquarters. Mr. Oldenbuttel's jurisdiction extends over the Second and Third divisions.

Ernest S. Newton, storekeeper of the Gulf, Colorado & Santa Fe, with headquarters at Clebourne, Tex., has been promoted to purchasing agent and storekeeper, with headquarters at the same point. Mr. Newton succeeds Thomas O. Wood, deceased, who held the title of purchasing agent.

T. A. Hodges, assistant general storekeeper of the Seaboard Air Line at Jacksonville, Fla., has been appointed general storekeeper, with headquarters at Portsmouth, Va. and the position of assistant general storekeeper at Jacksonville, has been abolished.

The Jurisdiction of A. E. Walters, division storekeeper on the Illinois Central, with headquarters at Memphis, Tenn., has been extended to include all material and supplies of the mechanical and other departments on the Mississippi division, succeeding G. D. Tombs, who had headquarters at Water Valley, Miss., and who has been assigned to other duties.

Obituary

Wyllis H. Markland, general shop inspector of the Pennsylvania at Altoona, Pa., died at the Altoona hospital on Feb. 7. Death was due to pneumonia. Mr. Markland was born on January 31, 1860, at Hampden, Conn. In 1872 his parents moved to Brooklyn, N. Y. and he entered the employ of the L. G. Tillotson Company, manufacturers of telegraph instruments, learning the trade under his father who was foreman of the shop. He was later employed by J. H. Burnell & Company, New York, a pioneer electrical firm. In 1883 he became foreman of the railroad telegraph shop of the Pennsylvania, at Altoona, Pa., and under his direction the shop force grew from eight to more than 200 men. He was promoted to general shop inspector in 1909. Mr. Markland was one of the founders of the Altoona Electric Supply Company and a president of the former Hollidaysburg Light Company. He was the inventor of a tong for lowering and removing cast iron car wheels from the annealing pits, which is used at the South Altoona foundries. He was also the inventor of a lapping machine for air brake valves. Mr. Markland, under a nom de plume, was a frequent contributor to the *Railway Mechanical Engineer*. He was also a contributing editor to the current edition of the Locomotive Cyclopedia.

W. H. Markland